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RAPID ELECTROCHEMICAL ANALYSIS.

In the early days of the electrical industry electroplaters seemed to avoid all chemical associations, and chemists also seemed to care but little about the new agent which was available for their operations. The study of the theory of electrochemistry, however, both because it opened a wide field for investigation, and because of the novelty of the ideas introduced, attracted a great many students, and to these, no doubt, must be credited largely the introduction of electrolytic processes for chemical analyses. However, the progress of this art of electrochemical analysis was slow. The old chemists knew but little about the subject and were suspicious of the results obtained. Nevertheless, the advantages of these methods were considerable, as they avoided tedious, and, in many cases, delicate chemical manipulations by the simple means of passing a current through a properly prepared solution. There was, however, one drawback to the process, if it may be considered as such: it usually required some time—perhaps several hours—to complete the separation desired, whereas a chemical separation might, in many cases, be carried out in a fraction of the time. The electrolytic process thus demanded patience of the analyst, though it might be said in its favor that the current, and not the chemist, did the work. The time-factor was nevertheless an objection.

With the object of overcoming this undesirable feature a great deal of work has been conducted at the University of Pennsylvania under the able direction of Dr. E. F. Smith, and a summary of this work was given in a brief paper presented by him at the recent American Electrochemical Society meeting.

The line in which Dr. Smith has been working was suggested many years ago by Gibbs, but only recently applied. This is the use of mercury as one of the cathodes. This metal will take up certain other metals with great rapidity when employed as the cathode, and it will retain these for future determination or transfer them to another point where they may be determined chemically. In this way the time required for analyzing a simple salt has been reduced from several hours to a few minutes. For example, all the copper may be removed from a sample of copper sulphate solution within ten minutes. The time thus compares favorably with the chemical methods, and, moreover, has the great advantage of not requiring the introduction of other chemicals into the solution in order to effect the separation. The pure acid is left in the cell and the copper is carried off in the mercury, so that both are easily determinable.

But this reduction in time is not the entire advantage of the

system, for Dr. Smith has found it easy to separate in this way metals which are separated with difficulty by the usual chemical methods. Moreover, for certain separations the process is simplified throughout. For example, halogen salts, when analyzed with a silver anode, give a solid deposit of the silver salt which need only be dried and weighed to determine the amount of acid radical in the solution. And there are other advantages accompanying the method, which seems to be suitable for wide use. Thus one of the main objections to the electrolytic method of analysis has been done away with.

TERMINAL FACILITIES INCREASED BY ELECTRICAL OPERATION.

One of the features of electric railway operation which, it was believed, would be of great importance at large terminals, is the reduction in the amount of switching and train shifting required. It was pointed out that electric trains operated on the multiple-unit control system would do away with the necessity of the switching locomotive for drawing the train out of the terminal, and thus avoid a certain number of train movements. When the important English roads began to introduce the electric system on certain of their suburban sections, this feature, it was said, would be one of very great importance. In discussing this, the manager of one of the English roads said that the multiple-unit system would cut down the number of train movements into and out of a terminal, and the number of signals required to carry out these movements, to one-half. A train drawn by a locomotive enters the terminal, is then followed by a locomotive which draws out the train, and the locomotive which brought the train in then follows the train out. There are thus four train movements, and two signals are required for each movement, making eight in all. With an electric train the train enters the terminal, the engineer walks to the other end and takes it out again. There are thus only two movements, requiring but four signals.

Ever since the New York Central & Hudson River Railroad started on the electrification of the New York zone and terminal, considerable interest has been shown in this phase of electrical operation, and it was hoped that the introduction of new power would not only avoid the discomforts and dangers of the Park avenue tunnel, but that the improvement in service which would be possible by the increased terminal facilities would alone be sufficient to warrant the great expense incurred. This phase of the work is discussed in the *Railroad Gazette* for April 26. It is there shown that even with the present incomplete transformation a very considerable diminution in the number of train operations has been secured. It should be remembered in this connection that there will be two characters of trains running into and out of the Grand Central terminal. The through trains will be hauled by electric locomotives, and this, of course, will not in any way reduce the number of train movements, though it may be pointed out that the electric locomotives do not require every-day overhauling at the roundhouse, but call for merely a side-track and a barn. The suburban trains, on the other hand, will be operated on the multiple-unit system, and for this there is being provided a loop connection, enabling a train to enter on one track, discharge its passengers, pass over to another, and reload for another trip. This plan will, of course, very considerably increase the facilities of train operation.

Since December of last year all trains, both through and local, on the Harlem division have been changed over to electric operation. These trains run into the new temporary Lexington avenue terminal. During April electric operation of the Poughkeepsie local trains was begun. These still run into the old Grand Central Station. Some of the through expresses are also being hauled by electric locomotives, and these locomotives are doing a good deal of the through switching.

A recent time table shows that since November last, although there has been an increase of three regular trains, the total number of movements to and from the terminal on week days, even under the present makeshift conditions, is only 752. This may be compared with the number of train movements shown in the time table which took effect last November, when it was 1,213. There is an apparent decrease here of 461 train movements, but it is pointed out that sixty-eight of these are construction train movements, so that the saving is only 393. This, however, is a decrease of over thirty per cent. Of these movements 381 were light engine movements, which are now eliminated, as the steam locomotives are run into and out of the station with their trains, even when the latter are hauled by electric locomotives. When the new terminal has been completed and all the steam operations are done away with, the saving in movements, and therefore the increase in facilities, will, of course, be even more noteworthy. But, as our contemporary points out, "The success of electric operation in helping out the terminal congestion has been already proved."

USE A TELEGRAPHONE.

A correspondent of the New York *Times* complains that he is frequently much annoyed and interrupted in his work by telephone calls from people who, if they called themselves, would be required to wait in the outer office a convenient moment. When the call comes over the wire, he, as does every one, feels under an obligation to receive it at once. He asks whether this nuisance could not be avoided, or at least diminished, by means of some recording apparatus which could take down many of these messages. Our contemporary suggests that the phonograph might supply the means desired. But there is already a much better arrangement than this, a device, in fact, created for this very purpose of recording telephone conversations. It is known as the "telegraphone," and was invented by Vladimir Poulsen. It records the message on steel, instead of wax, and happily avoids the annoying scraping noise inseparable from the ordinary phonograph.

This one fault of the telephone has been complained of again and again. Every one is at times seriously annoyed by it. Yet we seem to forget that the very feature which is a nuisance when others are calling is the one feature which makes the instrument invaluable to us when we call ourselves.

FLEET TELEPHONY.

Commander Bradley A. Fiske, U. S. N., in the current issue of the *Proceedings of the United States Naval Institute,* discusses an interesting plan tried for maintaining telephonic communication between vessels of a fleet. The chief object of this is to keep up communication during fogs and thick weather, and thus enable the fleet to maintain its course and formation unaffected by the fog.

The plan proposed and tried is to connect the successive vessels in line by means of a telephone cable, so that communication may be had between any two of them. The experiments made were not altogether satisfactory, but this was not due to any defect of the system, but merely to the lack of a proper telephone cable. There was found to be no difficulty in maneuvering two vessels when connected together in this way by a light line.

The plan here suggested is simple and inexpensive, and would probably prove entirely adequate for the purpose intended under all usual conditions; but it seems likely that under unusual conditions, say, in very rough weather or when, for other reasons, it becomes difficult to maintain a strict formation, that trouble could most likely be expected; and, of course, it is just at these times that the intercommunication between vessels would be most valuable. However, this fault is not peculiar to the system proposed, so that in this respect it is no worse than the usual method of signaling.

One naturally asks why wireless telegraphy might not be used for this purpose, but, as Commander Fiske points out, this system is reserved for other uses, and therefore should not be here employed. But why could not a system of wireless telephony be used? True, we have not as yet any entirely satisfactory wireless system, but we hope the time will not be long before we have. Such a system would, of course, be ideal, and if the range of transmission were not great it would be free, to a large extent, from one objection of a wireless telegraphic system, which distributes its message throughout a wide area, and thus is just as likely to deliver it to an enemy as to the vessel for which it is intended. It is possible that that system which employs a beam of light for transmitting the signals would answer for this purpose, and in this there would be no danger of delivering the message to those for whom it was not intended. But it is also probable that this would break down in unusually thick weather. It might be that a red beam of light could be employed, which would give a much better range of communication during fogs. A disadvantage of this system would be the inability to communicate simultaneously to all of the vessels in the fleet. In clear weather such a system would undoubtedly prove exceedingly useful and convenient.

LIGHTHOUSE LAMPS.

A press dispatch from London says that complaint has been made about the light given by the Lizard lighthouse. The difficulty seems to be in the inability of the light thrown out from the lamps to penetrate far during foggy weather. The lamps are electric lamps, but occasionally the light from them can not be seen, although oil lamps used upon the shore are visible.

Although it is not said what type of lamp is used in the Lizard lighthouse, it is doubtless an arc lamp. It is well known that the light given by these lamps is whiter than that of oil lamps; in fact, when contrasted with the latter it has a purplish tinge. It is also well known that fogs absorb the shorter wavelengths of light more readily than the longer. This is the reason why the sun or other luminous bodies seem redder when viewed through a fog or cloud. Hence a light rich in the shorter rays will suffer more absorption from a fog than one having a greater proportion in the red and yellow. An arc lamp loses more than an incandescent or an oil lamp.

But the quality of light given by the arc lamp, while generally white, may be varied. The yellow rays may be added when desired, and, in fact, when this is done, the luminous efficiency of the lamp itself is enormously increased. The so-called flaming or luminous arc is a lamp of this character, and in addition to its richness in the red and yellow rays, has an enormous intrinsic brilliancy, which would seem to make it well adapted for lighthouse purposes. It requires a little more attention than the older type of arc lamp, but for lighthouse uses this would not be an objection.

ELECTRICAL DRIVING FOR FIRE ENGINES.

It seems strange in these days when electric power is always available everywhere in a large city that advantage should not be taken of it for driving the pumps employed for fighting fires. The method to-day most widely used in this country is a steam-driven pump drawn by horses. A promising improvement is the introduction of the mechanically propelled fire engine, but although this seems to be meeting with much favor abroad, but few of them are in use in this country. They, of course, have very great advantages over the horse-drawn vehicle.

But it is another feature of the fire engine to which attention is here directed. The equipments at present in use consist of a steam pump and a rapid-steaming boiler. These equipments are, of course, heavy. Moreover, it is necessary to keep up steam within the boiler, and the latter is always dependent upon a supply of fuel. If the boiler and engine were done away with and replaced by an electric motor with suitable cables for drawing its power from the city supply, a much lighter, or, what would be much better, a much more powerful pump could be adopted. It would be entirely independent of fuel supply and ready to start at any moment. It could work continuously with practically no noise, and give off no smoke to interfere with the work of the men. An outlet for securing electric power could be installed at every fire plug, and connection with the electrical supply would be a simpler and quicker operation than connecting on the water hose. The reliability of the supply could be easily insured by arrangement with different power-houses in the city, but there is little likelihood of trouble on this score, as certain power systems in our large cities have not been without current for ten years or more past.

The Fifteenth Annual Report of the General Electric Company.

The fifteenth annual report of the General Electric Company, presented by C. A. Coffin, president, shows the profits of the company for the year ending January 31, 1907, to be $8,427,842.68. There was paid in dividends during the year $4,344,342, and $999,999 was written off from the patents, franchises and good-will account, leaving $3,083,501.68 to be carried to the surplus account. The total surplus on January 31 was therefore $15,110,796.77.

The sales billed by the company to its customers for the past year were nearly $17,000,000 more than for the previous year, showing an increase in shipments of about forty per cent. The sales billed for the first two months of the present year are more than fifty per cent greater than last year. The total amount billed to customers was $60,071,883. The total orders received amounted to $60,483,659.

Sales of supplies and small apparatus, such as meters, transformers, motors, arc and incandescent lights, wiring devices, have increased thirty-five per cent over the previous year, and stationary motors to the number of 40,365, aggregating 565,000 horse-power, were sold during the year. The consumption of incandescent lamps has been very large, and great difficulty has been experienced in supplying the demand. The production of metal and metallized carbon filaments is rapidly increasing.

In manufacturing, the expenditures aggregated $3,834,123.80. The land area of the three plants at Schenectady, N. Y.; Lynn, Mass., and Harrison, N. J., is about 445 acres. The total book value of all the land and buildings, excluding machinery, etc., is $5,363,812.88. At the Schenectady works a building of 237,000 square feet floor area, which will be used for the manufacture of large apparatus, is now nearing completion. There are also under construction a blacksmith shop and a boiler shop aggregating 39,000 square feet; an extension to the power-house of 181,000 square feet; wood-working plant, 80,000 square feet, and 26,000 square feet additional for the manufacture of wire and cable. Important extensions aggregating 370,000 square feet have also been authorized. At the Lynn works an extension to the turbine building of 45,000 square feet has been completed, and buildings of 168,000 square feet, to provide increased facilities for the production of meters, instruments and other work will be erected this year. At Harrison a building of 60,000 square feet has just been completed for the manufacture of high-efficiency metallic-filament lamps. At Fort Wayne, Ind., a four-story building of 120,000 square feet has recently been purchased. This will be devoted to the production of incandescent lamps. The plant of the Stanley-G. I. Electric Manufacturing Company, at Pittsfield, Mass., has been used, to a large extent, for the manufacture of General Electric apparatus during the past year. The floor space at present available is 370,000 square feet, with 1,700 employés. There are now under construction extensions to this plant aggregating 178,000 square feet, which will be used for the manufacture of transformers, lightning arresters, switches and other apparatus.

The size and voltage of transformers for use in long-distance transmission work continues to increase. The company is now building on order a number of transformers of 7,500 kilowatts capacity for operation at 104,000 volts. High-tension switches have been designed and successfully tested for 100,000 volts operation.

GENERAL ELECTRIC COMPANY'S CONSOLIDATED PROFIT AND LOSS ACCOUNT OF JANUARY 31, 1907.

EXPENSES.		EARNINGS.		
Cost of sales (including depreciation of plants, $2,834,123.80)	$53,106,594.04	Sales		$60,071,882.99
		Royalties, dividends and interest on stocks and bonds, and sundry profits	$417,586.19	
		Interest and discount	114,660.00	
				532,246.19
Interest on debentures	74,395.01	Profit on sales of stocks and bonds		329,702.55
Profit for the current year	8,427,842.68	Increase in surplus of security holding companies, representing their net profits for the year		675,000.00
	$61,608,831.73			$61,608,831.73
Patents written off	$999,999.00	Surplus brought over from last year		$12,027,295.00
Dividends paid in cash	4,344,342.00			
Surplus at January 31, 1907, carried forward to next year	15,110,796.77	Profit for the year ending January 31, 1907		8,427,842.68
	$20,455,137.77			$20,455,137.77

During the year Curtis turbo-generators of an aggregate capacity of more than 350,000 horse-power have been sold. On February 25, 1907, one of the four 8,000-kilowatt turbines in operation at the Fiske street station of the Chicago Edison Company showed a steam economy, under unofficial test, of less than thirteen pounds of steam per kilowatt-hour.

On April 1, 1907, there were 110 multiple-unit electric trains and thirty electric locomotives in daily service on the New York Central & Hudson River Railroad. This service was satisfactory in all respects.

The steam road from Camden to Atlantic City, N. J., of the West Jersey & Sea Shore Railroad was electrically equipped with General Electric apparatus in the autumn of 1906, and has since operated with complete success.

Membership Committee, National Electric Light Association.

The membership committee of the National Electric Light Association is conducting a vigorous campaign looking to increasing the membership of the association and bringing about a record attendance at the thirtieth convention, which will be held at Washington, D. C., June 4, 5, 6 and 7. Among the attractive things which the membership committee is sending out are a series of letters received from central-station managers all over the country, setting forth the advantages of association membership; a circular letter pointing out some vital facts concerning the ability of central stations of any size to secure representation, and the desirability of their doing so; and attractive leaflets setting forth the facilities which are possible through association membership.

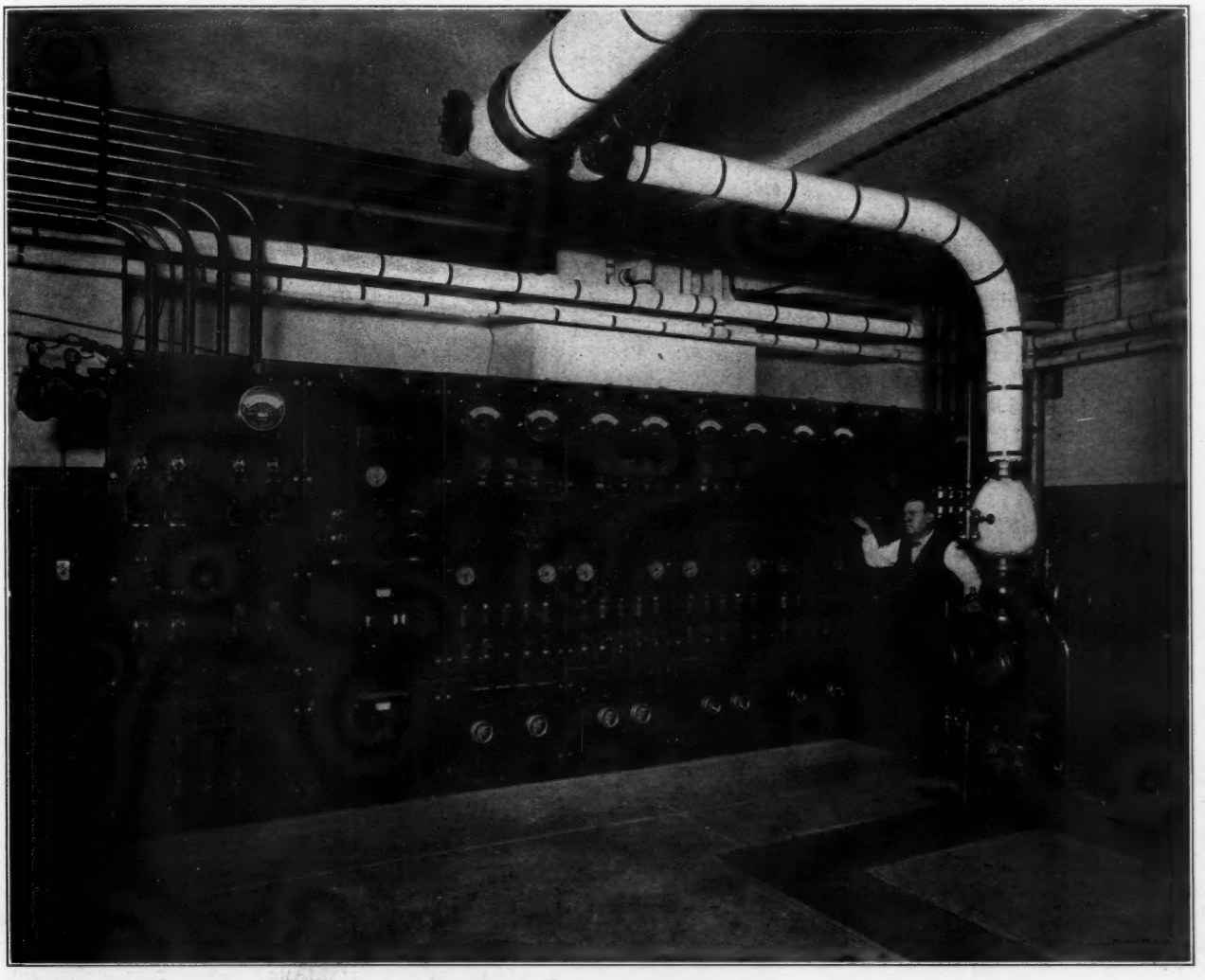
Two Hundred and Fifty Dollars for an Electrical Cooperator's Creed.

The Cooperative Electrical Development Association, Cleveland, Ohio, has offered $250 in prizes for the composition of an electrical cooperator's creed. The competition is restricted to men interested directly or indirectly in the electrical business. All compositions must be received in the office of the Cooperative Electrical Development Company, 1814 Forty-fifth street, N. E., Cleveland, Ohio, by May 31. The winning compositions will be printed in pamphlet form, with the name of the author, and distributed at the Washington convention of the National Electric Light Association, June 4, 5, 6 and 7.

Breaking the Record in Newspaper Making.

By Day Allen Willey.

WHILE time is of much value in nearly every industry, it is a question if it is more precious in any than in the production of the daily newspaper, owing to the increase in the demand for such publications and the keen competition between rival journals. It is needless to say that if a publisher puts a special or regular edition on the streets even five minutes ahead of his competitors he not only has the advantage of a larger sale of his papers, but his enterprise in "getting out" first is a valuable advertisement in itself. Consequently the efforts of inventive genius to perfect labor and time-saving machinery in connection with the newspaper industry have been as noteworthy as the design and construction of faster and more powerful locomotives and steamships to lower the record for covering distance on land and water. While the development of the newspaper printing press has been almost as remarkable as the improvements to grain harvesting and cotton-spinning mechanism, the inventor has also been working on the typesetters, even the matrix moulds and other preliminary appliances, so that at the present time the modern newspaper may be almost entirely a machine-made product, even to the preparation of the "copy" in its editorial and news departments.



THE SWITCHBOARD OF THE ELECTRIC PLANT OF THE BALTIMORE SUN, BALTIMORE, MD.

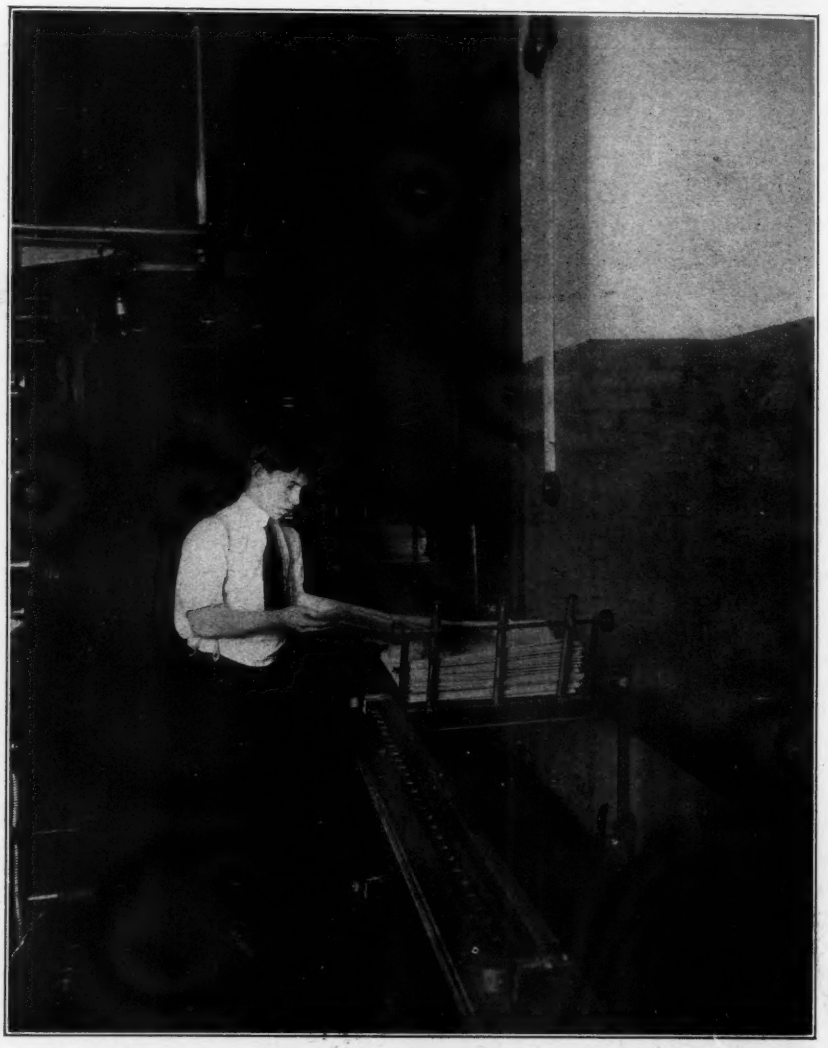
An excellent illustration of this fact is a plant which has recently been completed in Baltimore, where the records which have been made show that a sixteen-page, eight-column paper of the ordinary metropolitan size can be composed, stereotyped, printed and delivered to the distributors in what is believed to be a shorter period of time than is required in any other plant in the country to get out an edition of the same number. As this is due almost entirely to the arrangement and the mechanical installation, a brief description of the latter is of interest. The fire of 1904, which destroyed nearly every newspaper establishment in Baltimore, included the Baltimore *Sun*. Its owners secured a new site and decided to erect a building which would be devoted entirely to publishing the journal. They gave the architect and engineer retained *carte blanche* to provide for a structure and equipment which should include every feature that might reduce the time required in the several processes. The result is that while the *Sun* building represents a very large outlay, considering the object for which it is intended, the production of the paper is

accomplished in a remarkably short period of time, considering the size of an edition. The use of modern machinery has also demonstrated the fact that it is far more economical in the end, despite its greater first cost.

If we follow a paragraph of news matter or even an advertisement from the time it is written until it is placed before the reader, we can get a comprehensive idea of the truly wonderful part that mechanism may play in this industry. As fast as the mind of the reporter or editor frames a sentence it is placed upon the paper by the typewriter, every desk containing a machine by which copy can be finished far more rapidly than with the pen or pencil and, of course, far more legibly. The pneumatic tube takes sheet after sheet as revised by the editor and places it before the foreman in the composing room above. The battery of typesetting machines are provided with double as well as single magazines of type formers, so that one machine may not only set the body of the paragraph, but the headlines, although a separate machine is designed exclusively for headings. Thus hand composition has been reduced to such a small amount that an entire page of eight columns, including all the display advertising, may contain less than a half column set by actual hand labor. When it is stated that each of these motor-driven typesetters averages at least 6,000 ems an hour compared with less than 5,000 ems—the best record in most composing rooms of the larger American dailies—an idea of the time saving in composition alone can be gained, but machinery also enters largely into the making of the matrix. As fast as the form is made up, it is shoved on the bed of an impression moulder that is actuated by a two-and-one-half-horsepower motor. One movement of the massive mould roller over the sheet of *papier mache* placed on the form stamps the type into its soft, moist surface. As the moulder is next to the form tables, the steam tables are also in line with the roll, so that the form and matrix are placed on a table in a few seconds to be subjected to a steam pressure of eighty pounds, which partially removes the moisture. As this treatment occupies four minutes, enough tables are provided to press all of the matrices which can be moulded in that time. At the end of the steam tables, the circular matrix roaster revolved by a one-quarter-horsepower motor receives the matrices as fast as removed from the tables. Its centrifugal motion completely dries the matrix in fifteen seconds, with heat produced by gas.

The transfer of the matrices to the stereotyping room in the basement is accomplished by a chute, the end of which is within reach of the roaster. While the stereotype is made in a casting box, the plate is trimmed ready for the press entirely by electrically driven cutting tools. In fact, the operation of the casting boxes, the steam tables, the making up of the forms and the transfer of the form tables are the only hand processes employed from the time the paragraph is given to the typesetter until it is in the electrotype plate. This explains why a plate may be locked on the press bed in less than eight minutes after the form it represents is completed, although in that time the matrix has been moulded, pressed, dried, sent to the stereotype department and cast. It is doubtful if this record is equalled by any newspaper in the country.

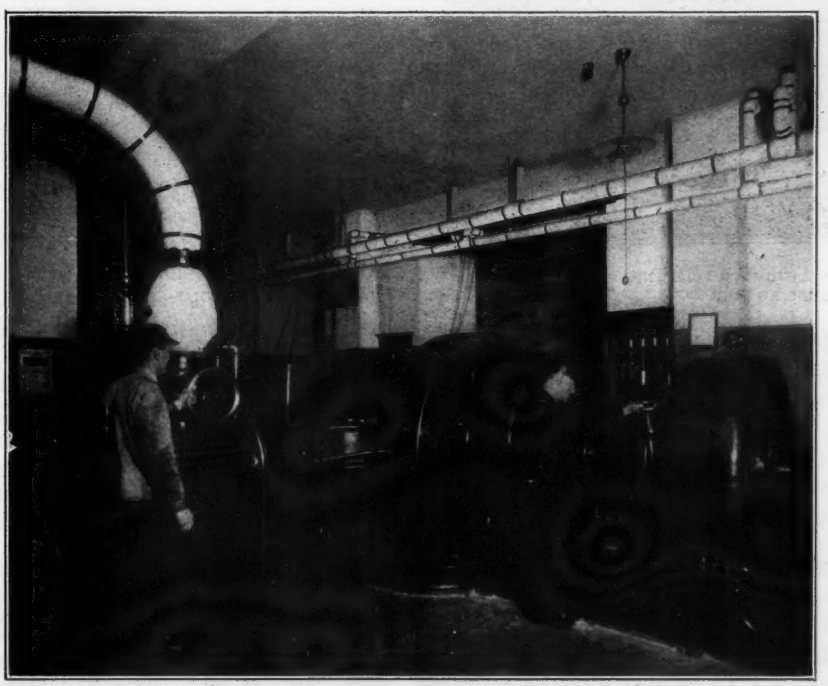
To return to the career of the paragraph we have been following, a stereotype containing it is fastened with the other plates of the paper on each of a series of four quadruple presses of the Hoe type. In an hour, if these have been running continuously, 100,000 newspapers containing it have not only been printed and finished, but taken from the press room and most of them placed in wrappers for mailing or in the hands of carriers for distribution. In other words, an edition of this size is not only produced, but delivered to the centre of distribution in the time mentioned. Passing over the question of the modern quadruple press, which, as the reader knows, not only prints but cuts and folds, the way in which the delivery is made is worth noting. Extending past the end of each press is an endless conveyer moving at the rate of 100 feet a minute. As the papers fall upon the delivery board of a press the "fly boy" with



THE ELECTRICALLY DRIVEN CONVEYER WHICH TAKES THE PAPERS AS FAST AS THEY ARE PRINTED AND FOLDED TO THE MAILING AND DISTRIBUTING ROOM. THIS CONVEYER HANDLES THE OUTPUT OF FOUR PRESSES, EACH RUNNING OFF 25,000 PAPERS HOURLY, AND IS SERVED BY FOUR BOYS, ONE TO EACH PRESS.

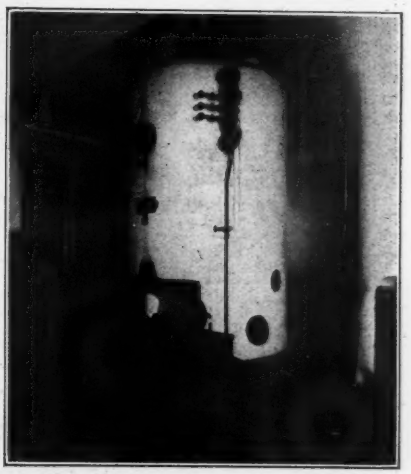
one motion of his arms places them on the conveyer as fast as they accumulate. To the end of the press room moves the conveyer, then up a vertical conduit to the street floor, where its freight is removed, counted and distributed to carriers and wagons as fast as the papers emerge through the chute.

THE DISTRIBUTING END OF THE ELECTRICALLY DRIVEN CONVEYER



THE ENGINE ROOM OF THE BALTIMORE SUN, BALTIMORE, MD.

The extremely low cost of producing a newspaper at the plant described is due not merely to the character of the equipment, but the care taken in planning the installation and the distribution of power. A steam engine developing 150 nominal horse-power is sufficient to actuate all of the machinery in the building through the system of electric motors devised. This means the four presses, two newspaper conveyers, twenty-four typesetting machines, matrix machinery, a passenger elevator, composing room repair shop, two thirty-horse-power air-compressors and stereotype finishing tools. The same engine also furnishes enough power to generate current for completely illuminating the building. This engine is direct connected to a compound-wound double generator on the three-wire system, with a capacity of 100 kilowatts furnishing 120-volt current for lighting and 240 volts for power. The complete power plant, which was installed under the supervision of Charles L. Reeder, engineer, consists of two engines and generating sets of the dimensions described and a seventy-five-horse-power set. One of the larger engines is held in reserve in case of accident, while the smaller is employed when only a part of the mechanism is to be operated. Only an engineer and electrician are on duty when the plant is running to its full capacity, while only one man is required to fire the three 150-horse-power boilers and to attend to the feed pumps and other auxiliary apparatus, making a total force of three for the entire power and light generating department.



VIEW IN THE BOILER ROOM, MECHANICAL PLANT OF THE BALTIMORE SUN, BALTIMORE, MD.

The motor arrangement is one of the most interesting features of the equipment. Each press is served by a thirty-five-horse-power motor. One seven-and-one-half and two five-horse-power motors actuate twenty-three of the linotype machines, the larger motor driving a series of ten. These motors, however, are sufficient for thirty machines if necessary. The head-letter machine is driven by a one-quarter-horse-power motor, while the matrix moulder, as stated, is attached to one of two and one-half horse-power. An emergency repair shop, fitted up with a lathe, milling machine, grinder, also metal-cutting saws and drills, is operated by a half-horse-power motor belted to a driving shaft. The two air reservoirs located in the press room have a capacity of 134 cubic feet each at a pressure of eighty

pounds and are used for the pneumatic tube delivery serving ten stations, also a sidewalk freight elevator, but their most important service is for a pneumatic ink distributor, which is one of the notable appliances of the press room. The distributor consists of a reservoir which holds 3,000 pounds of ink and is readily filled by gravity from a platform above it. From the reservoir, tubing extends to a conduit the surface of which is adjacent to the ink cylinder of each press. The conduit has a series of openings through which the ink is sprayed by air pressure upon the surface of the ink cylinder. The distribution of the ink is regulated by the speed of the press and the flow shut off when the press ceases its motion. No attendant is required for "inking," as it is done entirely automatically.

THE INK RESERVOIR AND DISTRIBUTOR, WHICH AUTOMATICALLY INKS ALL THE PRESSES BY MEANS OF COMPRESSED AIR.

The arrangement of the presses side by side allows the one conveyer to serve them all, though it is operated by a motor of only five horse-power. The site of the building, however, is over 200 feet in length and fifty-two feet in width, giving space for setting up the presses so that they could be operated in the most economical manner. Really a crew of two men and a "fly boy" are only needed to each press, as they are so installed that the paper can be fed from the roll even with the bottom of the press room and the time and expense of a lifting appliance required in so many newspaper offices are obviated.

Dr. Bell and Sound Transmission Over a Beam of Light.

The following interesting abstract is taken from the New York *Sun* of last week. The article from which the extract is made concerns the conferring of the degree of doctor of science upon Professor Alexander Graham Bell by Oxford University, May 2, in recognition of his efforts to teach the deaf and dumb to speak and for his invention of the telephone. The *Sun* has this to say:

"Becoming reminiscent about his other inventions, Professor Bell told the correspondent of the *Sun* that although everybody knew him as the inventor of the telephone, nobody outside a limited scientific circle knew him as the inventor of anything else. He was surprised to learn that his invention of 1880, the photophone, by means of which speech is transmitted by a beam of light, is unknown in England, except to scientists, although it was used in Germany to establish communication between lighthouses and the shore. This invention was due to the discovery of the enormous electrical resistance which selenium possesses. He described his experiments in the Franklin Building, Washington, in connection with the discovery, and his subsequent satisfaction at finding that the beams of the electric light answered the purpose of transmitting sound equally with sunlight. He added:

"'What surprised me, however, is that they are still using in Germany selenium, which is a most expensive mineral, whereas in 1880 I discovered that ordinary chimney soot, burnt camphor and similar forms of extremely cheap carbon possess the same advantages as selenium. Apparently the Germans are not aware of this, although I gave the discovery to the world twenty-five years ago.'

"Professor Bell recalled with amusement how, in connection with the invention of the photophone, he was attacked for having claimed to have invented something which never entered his head. He said he deposited in 1880 in the Smithsonian Institution a sealed package detailing his discoveries, and this becoming known led to the announcement that he claimed to have discovered how to see by telegraph. Numbers of people in America and England claimed priority of discovery, as, by the way, they did for the telephone. Scientific papers in the United States and England, as well as newspapers, warred against him. Then he opened the package in the Smithsonian Institution and showed that he never dreamed of seeing by telegraph. The storm then subsided."

The Berlin (Germany) Electric Railways.

It has been found necessary to remodel the entire system of the Berlin Metropolitan Railways. It is understood that the system will be modeled after the lines now being built between Hamburg and Altona, and will be operated with single-phase alternating current. The third rail is considered impracticable and an overhead line carrying a 10,000-volt alternating current will be used. Two new power stations will be erected, one at Westend and the other at Rummelsburg, each containing six 5,000-kilowatt turbo-dynamos. In the new system it is expected that trains will be run on an interval of every 100 seconds and that each train will accommodate 475 passengers. The trains will consist of four motor carriages and three or four trailers. The cost of converting the system is estimated at £11,000,000, and the capacity will be increased from 200,000,000 passengers a year to about 300,000,000. The annual receipts are estimated at £1,333,000 and the profits at about £333,000. On account of the heavy expense involved it is expected that the fares will be increased about fifty per cent. This vast project is expected to require about four years for completion, during which the whole of the present Stadt, Ring, and Vorortbahn systems will be changed to use the single-phase alternating current.—*Electric Railway Review, April 27.*

A PRACTICAL LIMITATION OF RESISTANCE FURNACES; THE "PINCH" PHENOMENON.[1]

BY CARL HERING.

The object of the present paper is to describe a limiting condition sometimes encountered in practice with resistance electric furnaces, which appears not to have been known and was very unexpected, and which may at times be serious and perhaps quite insurmountable. It applies to that type of resistance furnace in which the material to be treated forms the resister, in the form of a column of liquid in a trough, as distinguished from that type in which the resister is a foreign body like graphite of platinum, which is surrounded or enclosed by the materials to be treated. Of these two classes of furnaces, the latter is by far the simpler in theory, in practice and in operation. Innumerable difficulties encountered in the former are overcome in the latter, and it is probably a good rule to use the latter whenever possible in preference to the former.

As the reason for using an electrical furnace instead of a combustion furnace is generally the high temperature it produces, the conditions encountered in practice which limit the temperature may become very important. In the present paper, the term, limitation, will therefore be used to refer to those conditions which limit the temperature.

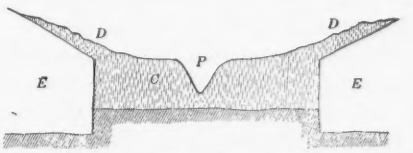
It is well known that if a wire be connected between the two poles of a source, it will be heated to a certain temperature. Now, if it be made shorter and shorter, and at the same time smaller and smaller in cross-section, so as to have the same resistance, it will become hotter and hotter, although the current and voltage, and therefore the watts, are the same. In other words, the watts per cubic inch are thereby increased. It might, therefore, be argued that by simply increasing the watts per cubic inch in a furnace, any desired high temperature may be reached, up to that of volatilization, which means the destruction of the resister.

This, however, is not the case. A limit may be reached which is far below this temperature, due to a curious and surprising phenomenon, which the writer has observed and which he has termed the "pinch phenomenon." This limit may at times be a very serious one, as it is sure to exist, and may sometimes limit the temperature to such a low value as to entirely defeat the object of the furnace.

[1] A paper read at the eleventh general meeting of the American Electrochemical Society, Philadelphia, May 2. Slightly condensed.

This phenomenon has apparently never been mentioned or described in the leading treatises and, therefore, does not seem to be generally known, and, as it may at times be a very serious limitation to the possible temperature in some electric furnaces of this class, it was thought that a description of it and its effect on their operation, may be of interest to furnace designers. Theoretically, this curious phenomenon is also of considerable interest. Dr. E. F. Northrup, of Philadelphia, to whom the author described this phenomenon some months ago, took a great interest in it, and made a very thorough and able study of it, both from the mathematical and physical, as also from the experimental standpoint, including also the quantitative relations. His very interesting paper was read before the Physical Society on March 2.

The phenomenon is as follows: When the current density in a liquid conductor in an open channel is increased sufficiently, the conductor will be found to contract in cross-section with considerable force, especially at a place where there is some



THE "PINCH" PHENOMENON.

slight obstruction in the channel, or where, for any other reason, the cross-section is less than the average. This contraction resembles the depression in plastic material that has been pinched between the fingers; as the column of liquid looks as though it were being pinched by some mysterious and invisible force, the writer termed it the "pinch phenomenon," for want of a better name.

In the adjoining figure, *E E* are the cold electrodes of such a furnace; *C* is the column of liquid conductor, which acts as the resister, and *P* is one of these pinched contractions. The liquid on both sides of the contraction slopes like the letter V, with inclinations of 45 degrees and over. The liquid will stay in this position, thus forming a stable state. The inclined surfaces of the liquid, though smooth, showed signs of great internal agitation, as though the liquid was continually running down hill, but was being as rapidly forced up hill again. It was a somewhat curious and interesting sight to see the surface of a liquid sloping at a steep angle and yet be in a stable state. The first impression was that a large leak had suddenly formed, and that the molten metal was rapidly flowing down and out through it; but it was soon found that the condition was a stable one.

When, under these circumstances, the current density is still further increased, this V-shaped depression becomes deeper and deeper until it finally reaches the bottom of the channel; this, of course, breaks the circuit and the liquids then immediately flow together, only to be instantly parted again, thus forming a violent automatic interrupter of the current, accompanied by a sputtering of the metal, loud crackling sounds, and, incidentally, by the great disgust of the man who is running the furnace, as it means that the limit has been exceeded, and if the circuit is not opened at once at the switch, to allow the parted liquids to flow together again to their normal level, there is a strong likelihood that the reduction of the current will cause the core to freeze in this parted condition, which gives rise to serious difficulties in mending the break so that it will carry current again.

If there is any dirt, infusible material or pasty, poorly-conducting slag floating on the surface of the liquid, it will naturally fall into this cavity, and as the conductor in the narrow neck is apt to volatilize, owing to the high current density, while the rest of it is apt to freeze, owing to the reduction of the current, the result is that a complete break is apt to form, through which it may be very difficult and sometimes impossible to start the current again, thus requiring a dismantling and reconstruction of the furnace. It is obvious that this phenomenon places a limit to the current, which can be passed through a liquid resister of given cross-section, thereby limiting the temperature which can be obtained. This limit may be far below that desired, thus completely defeating the purpose of the furnace. It, therefore, is an important factor to be taken into consideration by the designers of this class of furnace. What the limit of temperature will be, will depend, of course, on the particular circumstances; it is evidently not possible to give any fixed rule. It may, perhaps, be subject to calculation, but this is doubtful, as this local pinching seems to be originally induced by some obstacle or contraction in the channel, which, being generally accidental, is not within the reach of mathematics.

It is certain, however, that this tendency to pinching and consequent parting, exists and must be guarded against. If, for instance, a portion of the channel is made smaller than the rest, for the pur-

pose of increasing the temperature locally, great danger exists that this phenomenon will defeat that purpose, and it should first be determined by experiment, whether it will take place, before dependence is placed on the operation of such a design. Under some conditions this temperature limit will be quite low; with mercury, for instance, this pinch phenomenon will take place under favorable conditions before the temperature has risen appreciably.

One of the experiments made by Dr. Northrup, at the writer's suggestion, has shown that if the channel is quite uniform, the contraction in cross-section will also be uniform over its whole length—that is, the level of the liquid will lower uniformly, and, therefore, the danger of parting will not be so great. This explains the observation made by the writer that in a furnace of this type, the liquid conductor kept creeping up on top of the cold electrodes, as at *D D* in the illustration, piling itself up in large quantities, and solidifying after it got there. Fresh material had to be added for some time to keep up the level, until the stable conditions were finally reached. This stable condition is different for each current.

The question naturally arises, how can this pinch phenomenon be avoided. As the forces which cause it, namely, radial pressures toward the central axis, are bound to exist, the only way seems to be to render them as harmless as possible, instead of trying to resist them. To do this, the channel should be made as perfectly uniform as possible and kept free from obstructions. A very liquid flux should be used, if possible, to dissolve any solid foreign particles and to float or wash them away. The cold electrodes should have vertical faces where they are in contact with the liquid resister, so as to obstruct as much as possible the piling up of the liquid conductor at those places. When the current is stopped, the level of the liquid will become horizontal again, and will, therefore, rise, hence an additional range of regulation must be provided for starting up again with an enlarged cross-section. But, even with all these precautions, an increase of current density will lower the level until at some weak point a rupture will be likely to take place.

Another precaution is to make the channel as deep as possible, and, therefore, narrow in width. The writer noticed, and Dr. Northrup has since confirmed it by experiment, that the force which causes this pinching does not act to produce an unstable equilibrium; the contracting force reaches a stable state when it is balanced by the hydrostatic pressure of the liquid. Hence, by making the channel deep, the tendency to a complete break is reduced. This, however, necessitates making the channel narrow, thereby increasing greatly the tendency to develop a weak spot due to some obstruction or contraction. It also greatly increases the loss of heat through the walls of the furnace. Hence, both depth and width should be made large, which means short channels, low voltages, enormous currents, or else a large capacity of the furnace. In other words, the danger from this source is greatly increased as the furnace becomes smaller in capacity. Some idea of the strength of this contracting force may be had from a case in the writer's experience, in which the V-shaped depression extended down as much as six inches through molten iron to the bottom of the channel, causing a complete rupture, followed by freezing, which necessitated the dismantling of the furnace.

Another good rule is, do not use liquid resisters if the conditions permit using a solid one, which heats the materials by contact. There are other reasons, also, for this conclusion.

Those interested in this phenomenon from a physical standpoint, are referred to Dr. Northrup's paper, mentioned above. He therein demonstrates, mathematically, the correctness of the writer's first assertion, namely, that the contracting force was due to the encircling lines of force, and that its effect was, in some, though not in all, respects like that of stretched elastic bands, tending to compress the conductor radially toward the centre. He furthermore found that this compression produced a pressure at the centre, causing the material there to be forced out at both ends along the central axis, somewhat like when a rubber tube, filled with liquid, is squeezed or pinched with the hand, which will tend to force the liquid out at both ends. With a vertical column of mercury, he has succeeded in thus producing a small fountain of mercury issuing from the centre of a large conductor, and by letting this mercury flow back near the outside of the conductor, the fountain plays continuously; thus he produced continuous motion by merely passing a current through one conductor, without magnets, commutators, brushes, bearings, etc., presumably the first time such motion was ever produced. As was originally observed by the writer, the phenomenon is independent of the direction of the current, hence takes place with either direct or alternating currents.

The action might be explained, as Dr. Northrup suggested, according to the principle that currents flowing in a like direction attract each other. Hence, all the linear current elements in a conductor should be attracted to its centre, causing a contraction. This does not, however, explain why these current elements should drag the material of the conductor with them; why does not the current simply become denser at the centre? An electrical current passing across a running stream does not seem to be carried down with the stream as though it were inseparable from the water; but it always seems to take the shorter path across it; then why should the electric current, when in motion, drag the conductor with it as though it were inseparable from it? Yet it does do so in some cases, as in a unipolar disc motor, and one is therefore led to conclude that this matter has not yet been clearly explained by physicists.

The writer's belief is that his original suggested explanation is more satisfactory, namely, that this pinch phenomenon is due to some action of the ever-present encircling magnetic lines of force, which are all under tension like stretched rubber bands, and therefore exert a radial pressure on the material which carries the current. Dr. Northrup's mathematical investigations confirm this suggested explanation, in so far that he has shown that the contracted conductor has many more lines of force encircling it on the outside, than the original had, when both carry the same current; he shows that many additional lines of force are created by this contraction, and their radial pressures, due to their tension, have therefore been added to that of the others, which were there before; this would explain the increased pressure on the contracted conductor.

Although this phenomenon is a serious obstacle in electric furnaces having liquid resisters, it at once suggested to Dr. Northrup an application to simple forms of measuring instruments like those of the indicating and integrating types, that measure direct and alternating currents equally well, and it may raise in the mind of the inventor new visions of the possibilities of the long-looked-for commutatorless direct-current dynamo and motor, or self-starting single-phase, alternating-current motor.

An analysis of this phenomenon leads to many interesting deductions, which, however, are not in place in a paper on furnaces. One of these is that Ohm's law may perhaps not be strictly true for high-

current densities. Another is that the action of fuses and of the Caldwell interrupter may be due, in part, at least, to this phenomenon. Perhaps the action of the speaking arc is due to this phenomenon, as was suggested by Dr. Northrup.

This phenomenon should be clearly distinguished from the well-known and entirely different one, according to which a flexible circuit tends to enclose the largest possible area, and, therefore, tries to enlarge itself into a circle. The latter has been observed in induction furnaces, in which, it seems, the molten iron in the circular trough sometimes acts as though it were under the influence of a strong centrifugal force, and to such an extent that the bottom of the trough can be seen.

Annual Meeting of the Oklahoma Electric Light, Railway and Gas Association.

The first annual meeting of the Oklahoma Electric Light, Railway and Gas Association was held at Oklahoma City, Okla., April 22 and 23. J. H. Merrill, general superintendent of the Choctaw Railway and Lighting Company, South McAlester, Indian Territory, read a paper on "Interurban Railways." J. Cliff Leavitt, of Oklahoma City, read a paper on "Car Painting and Other Uses of Paint," and E. L. Callahan, Chicago representative of the General Electric Company, read a paper on "Increasing the Central Station Day Load." The annual address was delivered by the president, F. H. Tidnam.

The following officers were elected for the ensuing year: president, F. H. Tidnam, general manager Oklahoma Gas and Electric Company, Oklahoma City; first vice-president, Edward Reynolds, Tulsa, I. T.; second vice-president, J. H. Merrill, general manager Choctaw Railway and Lighting Company, South McAlester, I. T.; third vice-president, Fred Bentley; secretary, Galen C. Crow, general manager Guthrie Electric Light and Power Company, Guthrie, Oklo.; treasurer, W. J. Dibbens, manager Guthrie Gas, Light, Fuel and Improvement Company, Guthrie, Okla.

Executive committee: (for two years) H. C. Stetmund, Chandler, Okla.; C. T. Mercer, Geary, Okla.; (for one year) Clarence Klein, Tulsa, I. T.; and J. E. Turner, Elk City, Okla.

Committee on finance: Charles W. Ford, general superintendent Oklahoma City Railway; R. Wonderlich, Sulphur Springs, I. T., and W. W. Balington, Okmulgee, I. T.

Advisory committee: H. H. Stephens, El Reno, Oklo.; J. J. Paterson, Ada, I. T., and E. M. Cooper, Wilburton, I. T.

EXHAUST STEAM.

BY J. H. HART.

Almost every engineer, when he observes the exhaust steam pipe in the modern power plant, feels a distinct discontent over the constant economic loss there shown. This is an age of the utilization of waste and the development of valuable by-products in nearly every line of manufacture; and the inability to utilize this waste to any great extent is an object of concern to every thinking man. While this waste of heat is practically inevitable in the great majority of small operating plants, developments have to-day progressed to such an extent that there is no reason for the existence of this loss in plants which are sufficiently large to warrant the additional outlay for its utilization.

Exhaust steam at present can be utilized in three distinct ways, with distinct economies resulting from each of them. The possibility of the utilization of each and every one most efficiently depends on the surrounding conditions and the application to which the power is applied and from which the exhaust is obtained. This exhaust steam is used in heating, refrigerating, and drying devices to-day. The utilization of heat of exhaust steam for heating purposes is very old, and it is, of course, limited in its applicability. In the majority of cases the heating desired is dependent upon the season of the year, and in nearly every case it is totally inadequate to utilize the entire exhaust. The utilization of exhaust steam in large power plants for heating buildings in territory immediately contiguous to the property of the plant has been developed to a slight extent. In general, however, it has not been regarded as worthy of much consideration. The condensation of the steam and the consequent blocking up of the pipes, and the back pressure which results in diminished efficiency in the power unit, together with cost of installation and small returns, have prevented this development to any great extent.

The application to refrigeration is a somewhat new field, and is dependent upon the recent efficient development of the absorption machine in mechanical refrigeration. This machine has, for a number of years—in fact, almost since the installation of the first compression plant—been in considerable disrepute. As a refrigerating device it antedated the compression system, but was extremely inefficient. It used large quantities of water, also large quantities of steam, and hence heat, and, to cap the climax, produced little refrigeration. In order to understand this statement a complete review of the mechanism and theory of the absorption machine would be necessary. This does not appear essential here, but the statement may be accepted as true, that the absorption machine has been developed, by an elimination of these destructive factors, to an efficiency which, in most cases, is far superior to that of the compression plant, and which renders it, under many conditions, the most efficient system available for mechanical refrigeration. It will never eliminate the compression machine from the field, although its efficiency is at least fifty per cent greater, and some authorities even put this figure at 100 per cent. The absorption machine has been developed so that it can utilize exhaust steam efficiently for the evaporation of the ammonia. One pound of pressure may be utilized, and this need never rise over four pounds pressure in this work. This does not seriously inconvenience most power producers, and hence its development as an accessory in this field, for the production of by-products, is steadily increasing. It does not pay to use the absorption machine with high-pressure steam on account of the fact that the only thing that is used in this device is the heat in the steam, and this is very slightly increased with high-pressure steam in comparison to low-pressure steam. The reason for this is that the total heat in steam depends upon the temperature of the steam and the latent heat of vaporization. This diminishes with rise in temperature and pressure, so that the sum total of the two factors is not increased as much as is generally considered. The absorption machine finds is best development in the utilization of exhaust steam, and a refrigerating plant works at its best efficiency with high-pressure steam operating a compressor, and the exhaust from this operating an absorption plant. Thus a 100-ton compression plant operates on an eight to one basis; that is, eight tons of ice produced to one ton of coal consumed. An absorption plant of the same capacity operates on an eleven to one basis, whereas a combination plant, the absorption machine being operated by the exhaust from the compressor, and each being of a 50-ton capacity, will operate on a fourteen to one basis. Thus the utilization of exhaust steam in the absorption machine for the production of mechanical refrigeration is the most economic method of producing refrigeration. Further, an ordinary plant utilizes, in this development, a by-product which had formerly gone to

waste. The economic advantage of such a development has been so great that many power plants in southern cities now operate a refrigerating machine in conjunction with their power production for the trolley and lighting service. Further, the situation in this work is such that intermittent power is often available, and this is also readily available in the production of mechanical refrigeration. Hence these two developments are economically closely connected, and their connection commercially is at its inception.

The third utilization of exhaust steam is in its application as a drying agent. This requires the addition of superheat to prevent condensation, but this is easily applied. The mere extension of the exhaust pipe and its passage through the boiler, or its artificial heating from the outside, is sufficient to render this device acceptable and useful in many developments. The ordinary problems of superheated steam incident to the high pressures and temperatures which are developed become here of small consequence. The pressure is only slightly above that of the atmosphere, and comparatively high temperatures can be obtained in the superheater without a large first cost in construction and without the deterioration which is extremely common in ordinary superheating devices. Of course, the utilization of this steam as a drying agent is limited in its application. In the cotton mills of the South it has no equal as a drying agent for the yarn. It is also used in sugar works, oil factories, soap works, and a large number of other developments are possible and desirable.

This represents at present the situation in regard to the utilization of exhaust steam. Heating and refrigeration can be combined in accordance with the seasons for its best utilization in such a way that exhaust steam can always be utilized in large power plants. This is a development which plays no mean part in the total efficiency of the plant if properly utilized. The remaining development, while limited in its application, is unsurpassed under certain conditions, and presents a great saving in its utilization in this field. All these developments, however, are merely in their inception. Superheat of steam itself is uncommon in any application, and this extension must come to a great extent before the latter. Also mechanical refrigeration, especially in its production by the absorption system, is constantly undergoing changes, and this development also is at its inception, so that outside developments will not come for a number of years in any line.

Concession Granted for Power Plant on the Rhine.

Consul George Gifford, of Basel, Germany, reports that a concession has been granted by the authorities of the district of Lörrach, in the Grand Duchy of Baden, for a new electric power plant on the Rhine.

This project will require the building of another dam across the river between Wyhlen, in Baden, Germany, and Augst, in the canton of Baselland, Switzerland, the site of the old Roman stronghold of Augusta Rauracorum, about seven miles upstream from Basel. The Swiss canton named, as the sovereign of the left bank of the river, granted the concession on its part several months ago.

The cost of the new enterprise is estimated at $2,000,000 to $3,000,000, to be provided by the joint grantees, the canton of Basel city and the Power Transmission Works at Rheinfelden. The latter company will be the real contractor, and must begin its work within a year and a half and finish it within seven years, under penalty of forfeiting its eighty-year concession. The same corporation has already built and operated the famous water power plant at Rheinfelden, only three miles farther up the Rhine, which was one of the first great electric power works of the world, and still rivals in importance those at Niagara and at the falls of the Rhine, near Schaffhausen. The Rheinfelden works furnish light and power to German and Swiss towns and villages, and even to isolated farmhouses where silk looms are driven by electricity, within a circuit of twenty miles in all directions. The factories and workshops, not only on the Rhine, but on the Wiese, Birsig, Birs and Ergolz, are largely supplied from this source.

The city of Basel supplements its own steam plant by means of two power-transmitting wires, one on each side of the Birs, from Rheinfelden. But the power available from both works not being sufficient to drive the street cars, furnish light and satisfy the growing demand for power for industrial purposes and extension of the electric tramway system, it has long been a question of further utilizing the water power of the Rhine. Many projects have been discussed and abandoned, several of them having in view damming the river where it passes through Swiss territory alone, either below the city, toward the Alsatian frontier, or above the city, at Birsfelden. The project finally adopted in cooperation with the German Grand Duchy is hampered with all sorts of restrictions imposed at the instigation of many opposing interests. The persons possessing a monopoly of the salmon fishery at various points must be indemnified. But a much more important obstacle to the speedy completion of the work is the consideration that by the terms of the concession must be granted to the projected extension of the navigation of the Rhine, even above Basel.

The reopening of the great stream to freight traffic between Strassburg and Basel, after half a century of interruption occasioned by the building of railroads on both banks, has excited so much enthusiasm among its promoters that they dream of nothing less than a direct river route from Rotterdam to the falls of the Rhine, and beyond to the Lake of Constance, with river connections with the whole interior of the country. The Basel-Strassburg route, which is subventioned by the Swiss Confederation as well as by Basel and several other cantons, has already built a little harbor and dock in this city and has conceded the business of transshipping goods to a private corporation. Any project for further obstructing the stream, the navigation of which is already made so difficult by a series of pontoon bridges beginning at Hüningen, a few miles below this city, must accordingly reckon with vigilant and at present much excited promoters of another public enterprise of enormous importance.

Deflocculated Graphite in Water as a Lubricant.

E. G. Acheson, of Niagara Falls, N. Y., has invented a process for permanently suspending graphite in water or oil. This process will be known to the scientific world as the "Acheson effect." In the deflocculated condition produced by Mr. Acheson graphite has a condition of fineness far beyond that attainable by mechanical means, its condition resembling the molecular state. The "effect" is produced with water and a comparatively small quantity of gallotannic acid, and when thus treated the graphite shows not the slightest disposition to settle, the black liquid passing through the finest filter paper. Severe tests have demonstrated that it is an admirable lubricant.

The "Acheson effect" makes it possible not only to reduce graphite to practically the molecular state and to cause it to remain suspended in water for an indefinite period of time, but prevents rust or corrosion while associated with water, thus taking advantage of the high specific heat and low viscosity of water.

POWER COSTS.[1]

BY CHARLES E. LUCKE.

The fixed and operating charges are the same in nature for all different power systems, but different in kind in some cases. Interest may be figured at any rate from three per cent to six per cent, depending upon a large number of circumstances, which can not be gone into here, but whether the amount of investment, the interest of which is charged against power cost, will include real estate on which the power plant is built or not, is a question of doubt, and there is still more doubt, or rather lack of agreement, on the question of interest charges on real estate used for the storage of coal, ashes, or, in the case of water power, of land covered by the pipe-lines, reservoirs, dams, the property that had to be purchased to permit the rise in level of the natural stream after the dam is built. Not only is there doubt about the interest charges of this kind, but when real estate is in question there rises a possibility of credit item or an appreciation to offset the interest in the nature of what is so often called the "unearned increment." Depreciation as a fixed charge against power cost is an item on which there is practically no agreement except as to the necessity of including it in some form or other.

Depreciation may represent an amount which should be charged against earnings, each year, for the renewal of any part of the plant on the assumption that that part will need renewal. In this sense each part of the plant is given an assumed life of X years and the first cost of that part divided by X is charged off yearly to a sinking fund, but whether this sinking fund, thus created, should be considered as earning anything or not, or whether it should be considered invested at simple or compound interest or not, presents still another doubt. Depreciation may also be considered to mean the difference between the cost of the plant, or any part of it, and what it would sell for in the open market second-hand or as scrap, or, if real estate, at public auction. This depreciation of the present value of the plant or any part of it is naturally a very uncertain thing and open to manipulation by unscrupulous persons, who desire to make the plant appear better or worse than it really is, as well as being open to honest misunderstanding based upon difference in judging. The third possible meaning for depreciation is quite different. It is assumed that the plant exists for making money. It, therefore, has a certain earning capacity and is capable of yielding certain profits. So long as it is capable of continuing to earn these profits it may be assumed to have a value equal to what it always had, and, therefore, depreciation is nothing. This depreciation is judged solely from the point of view of the earning power of the invested capital in the particular business in question. This is rather the unusual point of view.

It is certain that if the machinery and equipment of any kind be thoroughly overhauled and repaired that it will be worth more than if it had not been overhauled, and therefore, it would seem that depreciation should have some relation to the item of "repairs and maintenance," which is usually considered an operating charge. This relation is, however, seldom given proper consideration.

The third class of fixed charges common to all systems is the item of insurance and taxes. Insurance itself may cover fire, water, flood, lightning, accident and employers' liability, and is dependent upon the original investment or the amount of liability in question. It may vary from one-half of one per cent to ten per cent of the total amount invested, excluding real estate and accident and employers' liability, which, of course, can not be valuated. Taxes are dependent upon municipal and state regulation, and are so different in different localities that while the item should be charged against power cost in any case, in comparing costs this should be eliminated.

The usual practice in comparing systems involving different charges is to give to each a reasonable value, but the discussion will enter, "What is the reasonable value?" and whether that value should be different for different systems.

Operating costs should, of course, include all labor, including beside that immediately concerned with the running of machinery also an amount for bookkeeping, superintendence and even janitorial. All fuel, all lubricating oil, grease, waste, pipe fittings, fuses and other material used about the plant, either for operation, maintenance or repairs, is properly an operating charge, but so are also smaller items, such as expressage, telephone bills, ice water and little things nearly always forgotten or charged to that indefinite account, "general expenses," which means nothing.

In charging these items to operating expenses it is common to simply report for water power, "labor and maintenance," as one item, and "supplies" for the other, giving only two items for operating expenses, while for steam, gas and oil power plants there are four, (1) fuel, (2) operating labor, (3) oil, waste and miscellaneous supplies and (4) maintenance and repairs, including both labor and materials.

WATER POWER.

Water power generally is the cheapest, but is not always necessarily the cheapest. The water itself costs nothing, but it can not be used as nature provides it. The cost of preparing it for proper use in wheels and of providing for its control will involve a considerable expense, as a rule, and the interest on this expense will correspondingly be the largest charge against power cost, and will, as far as its importance is concerned, be commensurate with the fuel charges in gas engines, steam engines or oil engines. The cost of developing water power depends almost entirely on the local situation, and can not be reduced to any formula or rule. In the early days of the water power development—say over 1,000 horse-power—only low heads were utilized and the wheels located at the side of the dam, making the total development involve nothing more than a timber and stone dam with a house at one end. As the demand grew for more power from the same stream it was necessary to dig a canal to bring the water around the original power-house to some other house. Thus the expense began to increase from difficulty of bringing the most water to the wheels under the largest heads by long pipe lines or combinations of pipe lines, canal flumes, tunnels and vertical shafts, so that the cost has materially increased. The simpler development complete cost somewhere about $40 per horse-power without electrical equipment. This has now increased so that a minimum of $75 per kilowatt is considered a very good proposition, while a maximum of $200 per kilowatt is not by any means prohibitive, including electrical equipment. The mean is somewhere near $100 for very large installations favorably placed. Taking these two limits and a gross interest charge of five per cent with an average depreciation of four per cent, with insurance and taxes at one per cent, there is a total charge of ten per cent on the first cost, or $7.50 per kilowatt-year as a low limit, and $20 per kilowatt-year as a high limit. The operating expenses, labor, oil, waste, repairs, etc., may be expected to cost from $1 to $5 per kilowatt-year, which places the cost of

[1] A paper read at a meeting of the New York Section of the American Electrochemical Society in New York, February 26, 1907, and read by title at the annual meeting of the society, Philadelphia, Pa., May 4.

electric power at the bus-bars between the real low limit of $8.50 per kilowatt-year and the high limit of $25 per kilowatt-year for full load, twenty-four-hour power for these rates of charging expenses. Beside the increase in development cost there is another item that sometimes enters, and that is an increase in land expense or land damage, which may be in settled communities. The increase in cost is not at all due to increase in cost of machinery; this has probably decreased, not only from a better method of manufacture and more competition, but from the use of high heads and wheels and electric generators.

Just how much can be paid profitably for the development of water power, either now or in the future, will be measured solely by the power cost of one of the competing systems most available, steam, gas or oil, in the same locality, or if not in the same locality at some point within the limits of electrical transmission. To the cost of generating water power must be added transmission cost, involving fixed charges, on lines, transformers, switchboard and other equipment, together with their maintenance and operating charges. All of these together may add to first cost $30 per kilowatt and increase the power cost for a 150-mile transmission $5 per kilowatt-year.

OIL POWER.

Oil engines are not built in large sizes and the variety of engine on the market is small. Therefore, for plants of 1,000 horse-power or more, multiple units are necessary, and for a twenty-four-hour output spare units must be installed to insure continuity of the output. The first cost, therefore, must be that for more horse-power than is needed, and just how much more will depend upon the number and size of the units, and will vary from twenty per cent to fifty per cent. If there are many small units twenty per cent additional installation will be sufficient. If there are only a few large units, twice as many may be necessary as is actually called for by the output; in any case the more spare units the less the chance of discontinuity of output and the safer the guarantee of twenty-four-hour power.

To keep a fair proportionality between the computations on the various systems with respect to their size, oil engines of 250 horse-power will be taken for example, coupled to 160-kilowatt generators to enable overload capacity to be used. Six such units will be assumed for a station operating on a twenty-four-hour load, equal to the output of four or a rating of 640 kilowatts. These engines should cost $62 per horse-power, or $97 per kilowatt of generator rating. The oil station, including foundations, piping for oil, water and exhaust, electrical equipment, building, crane, etc., should cost about $145 per kilowatt on the maximum rating, or 150 per cent of this on the twenty-four-hour guaranteed load rating, or $217 per kilowatt. Taking the fixed charges, including interest, depreciation, insurance, and general office expenses, as equal to ten per cent per year on the first cost, the yearly fixed charges become $21.70 per kilowatt-year. This plant will require continuously one engineer, at about $100 per month, and four engine operators at about $60 per month, which for the above conditions works out fifteen cents per kilowatt-hour. The engines should use fuel oil, costing about two and one-half cents a gallon, and should consume about fifteen gallons per kilowatt-hour. This gives the operating power costs or the manufacturing power costs as follows:

	Per Kilowatt-Hour.
Fuel Oil	.38
Lubricating oil, waste, etc.	.04
Operating labor	.15
Maintenance and repairs	.08
Total	.65

For a year of 8,760 hours this amounts to $56.94 per kilowatt-year. Adding this operating cost to the fixed yearly charges of $21.70 per kilowatt-year gives a total power cost of $78.64 per kilowatt.

Any change in the cost of fuel from that assumed will affect the result. Changes in local conditions and price of labor, different grouping of engines to make more or less men necessary, insurance, interest and repairs will all have their effect on this cost. A more economical engine than this one assumed will have the effect of lowering the fuel oil cost, but it will very slightly increase the lubricating oil, especially that used in the cylinders, so that these two would tend to compensate.

STEAM-POWER STATIONS.

There is practically no limit to size of steam-power stations with reciprocating engines, but there is a practicable limit to the size of units, and very large powers are to be obtained by multiplying these units. In order to make a fair comparison, a steam-power station will be assumed of the most economical type, but not necessarily the largest size, but involving very close to the largest units. This is what was done with the oil plants, although there the line of separation is not quite so marked as here. As a typical example, assume a 20,000-kilowatt, twenty-four-hour load. The station to carry this must be, at least, of 30,000-kilowatt capacity, which for 5,000-kilowatt units calls for four at work all the time; two in reserve with auxiliaries and boilers accordingly. Such a station with all the latest labor-saving devices, with coal at $30 per ton, and water at $1 per 1,000 cubic feet, will have about the following division of operating power costs:

	Per Cent of the Total.
Coal	64
Water	8
Operating labor	12
Oil, waste, etc.	4
Maintenance and repairs, including both labor and supplies	12
Total	100

Such a station may be expected to operate year in and year out on about two and one-half pounds of coal per kilowatt-hour, and about thirty pounds of water per kilowatt, including that for the engines, as well as for cleaning, washing, heating, etc. At these rates, with the above division of power costs we have the following:

	Per Kilowatt-Hour.
Coal	.380
Water	.048
Oil, waste, etc.	.024
Operating labor	.076
Maintenance and repairs, including labor and supplies	.072
Total	.60

With this twenty-four-hour load throughout the year of 8,760 hours per year, the cost per kilowatt-year, excluding fixed charges, will be as follows:

	Per Kilowatt Year.
Coal	$33.29
Water	4.20
Operating labor	6.66
Oil, waste, etc.	2.10
Maintenance and repairs, including labor and supplies	6.31
Total	$52.56

Such a station as this may be expected to cost, excluding real estate, but including vertical reciprocating engines, boilers, stokers, stacks, condensers, feed-water heaters, economizers, boiler feed, hot-well and dry vacuum pumps, house service pumps, exciter units, steam, water and exhaust piping, pipe covering and painting, drip return system, lubricating oil system, plumbing, coal and ash-handling system, house heating system, elevators, cranes, electric generators, switchboards and wiring, and building complete, from $110 to $150 per kilowatt generator rating. Taking interest, depreciation and general office expenses, equivalent to a total of ten per cent per year on the first cost, there results fixed charges from $11 to $15 per kilowatt-year on the expected output rat-

ing. For the twenty-four hours, however, there is provided, in this station, a fifty per cent reserve on the rating, so that the actual charges will be 150 per cent of this, or from $16.50 to $22.50 per kilowatt-year. Adding this to the manufacturing power cost of $52.56 per kilowatt-year gives as a fair value for the total power cost of such a highly refined, large, steam station $69 per kilowatt-year to $75 per kilowatt-year. Of course, changes in the design of the station and local conditions may lower this operating power cost, but not very much. Fixed charges can, as a rule, be reduced only by simple arrangements and cheaper apparatus, which will involve as a consequence less economy and higher operating costs.

A small steam station very much less economical than this will involve power costs much higher than this. The stations will be cheaper, but it will burn more coal and require more labor. The power costs, as shown by some of these smaller stations, may be over one cent, and as high as five cents, for very small stations per kilowatt-hour, which is from two to nine times the operating costs assumed for this large station. The first cost of the equipment may be as low as $75 per kilowatt, which is approximately half what was assumed for the large, refined station. The results of such a variation will be a higher yearly power cost than assumed above for the smaller station.

GAS POWER.

The use of steam turbines in place of reciprocating engines will have the effect of reducing first cost approximately $10 per kilowatt, and it will also have the effect of increasing the coal and water costs and decreasing the operating labor costs. The net result will probably not be very different than for the reciprocating engines. If there is to be any change, it will probably be an increase in power cost, rather than a decrease, excepting where real estate is included, and real estate at the same time very expensive. The small space occupied by the turbines will decrease the fixed charges on real estate probably enough to bring the balance of total power cost, in such a station, slightly in favor of turbines.

Gas-power stations involving gas engines and producers have not yet been built as large as steam stations, and 1,000-horse-power units may be assumed to be, in connection with 600-kilowatt generators, about the largest size units on which there is practical data of long-period operation. Taking up for a typical gas station one containing four such units of work and two in reserve, the station would be capable of delivering four times 600, or 2,400-kilowatt, twenty-four-hour loads every day in the year. The station would, however, have a maximum rating of 3,600 kilowatts. Such a station would cost approximately $180 per kilowatt complete, the engines and producers costing $56 per kilowatt, unset, and the rest of the first cost of the station being divided up between foundations for engines and producers, electrical equipment, gas, water, exhaust, steam and air-blast, compressed-air piping, coal and ash-handling apparatus, exhaust silencers, gas-holder for regulating pressure and controlling producer, air-compressor and tank for starting, building, crane, small auxiliary boiler for producer house, and all auxiliaries and incidental apparatus.

As the station output actually counted on is only two-thirds of the maximum rated capacity, the fixed charges must be figured on the basis of 150 per cent of $180, or $270 per kilowatt for first cost. When, as before, the fixed charges, including interest, depreciation, insurance, general office expenses, etc., equal ten per cent yearly of the first cost, there results a fixed charge yearly of $27 per kilowatt-year, as against $22.50 maximum for the steam station. This station will be charged nothing for water, because there are no boilers to scale, except the small auxiliary producer boiler, which may be neglected. If, however, water is to be charged in any particular case, it may be figured on 200 pounds, circulating, necessary per kilowatt-hour for all purposes. The coal consumption will work out, in such a station as this, about one and one-half pounds per kilowatt-hour, the coal being anthracite that can be depended upon, with the apparatus in ordinary condition in the hands of ordinary operators, the year around, and are drawn from actual experience, and not from any particular test with everything in fine condition and correct adjustment.

The coal cost per kilowatt-hour will be, on the above basis, twenty-two cents, and the other operating costs can be figured from the following distribution:

	Per Cent of the Total.
Coal	50
Operating labor	23
Oil, waste, etc	7
Maintenance and repairs	20
Total	100

This gives for the operating power costs the following:

	Cents per Kilowatt-Hour.
Coal	22
Operating labor	10
Oil, waste, etc	3
Maintenance and repairs	9
Total	44

This is equivalent to $38.54 per kilowatt-year of 8,760 hours. Adding this operating cost to the fixed charges of $27 per kilowatt-year, gives, for the total power cost of such a gas plant, $65.54 per year, which is somewhat less than obtained with a very much larger steam station of economical design. The saving in total power costs will be even more for smaller stations; steam and gas of the same size as the gas power costs do not vary much with size, while steam power costs do. It is also interesting to note, in this comparison, that the considerable excess in first cost in the gas-power stations is overbalanced by the economy of operating power costs so as to bring the total less than for the steam station.

These costs may now be summarized for comparison as follows:

	Water Power.	Oil Engines.	Gas Engine and Pro.	Steam Engine.
First cost per kw. rating	$75.00—200.00	160 kw. units $217.00	600 kw. $270.00	5000 kw. $110.00—150.00
Fixed charges, rate per cent	10 per cent.	10 per cent.	10 per cent.	10 per cent.
Fixed charges per kw.-year	$7.50— 20.00	$21.70	$27.00	$16.50— 22.50
Operating and mfg. costs per kw.-year	1.00— 5.00	56.94	38.54	60.00— 75.00
Total power costs per kw.-year	8.50— 25.00	78.64	65.54	

No. 1 buckwheat, which may be assumed to cost $3 per ton. This coal consumption will be practically the same for any size of plant, and it is interesting to compare it with what might be expected in steam plants, which for even the large size assumed of the highest economical type is two and one-half pounds per kilowatt-year, and for smaller steam plants, such as this with 600-kilowatt units, might easily run up to three or four pounds per kilowatt-hour. These coal consumptions are, of course, not the best that can be obtained in any of these plants, but figures

Comparison of power costs on assumed conditions; stations consisting of six units, two in reserve and four working on twenty-four hours rated load, with the exception of the water power. First cost and fixed charges are based on the capacity of 150 per cent of the output.

From these figures it appears that we have not yet reached the limit of cost of development of water powers which may be advisable. It apparently would pay to spend even more money than $200, the present maximum per kilowatt for water-power development, if there are no other

considerations entering. Among the chief considerations of this kind may be set down that of transportation of products from the works and raw material to the works, but this must be considered against the question of transmission of current from the waterfall to a convenient point of transportation.

It is interesting to note how close is the cost competition of the three fuel systems for the conditions assumed for each.

Excluding the water power plants, the first cost of the steam plants will be least, oil second, and gas engine greatest, with the fixed charges in proportion. As oil fuel is very much more expensive than coal, when referred to the heat content, and the thermal efficiency of the oil engine not as much greater in general, it follows that the fuel element in power costs will be greater than for the steam or gas plants, except when small and load intermittent. This fuel element will always be less for gas plants than for steam when the same coal is available for both. This fact, compared with the increased fixed charges for gas plants, makes it likely that gas power will be cheaper than steam when the load factor is high, and the difference will be greater the greater the cost of coal. Smaller units in every case will have the effect of increasing labor cost per kilowatt-hour, but not in proportion to size reduction. Oil, waste, miscellaneous supplies and maintenance and repairs will depend on the complication of apparatus, its service, and the quality of labor employed, but its value is problematic and can not be predicted, except by experience with similar apparatus, which gives figures on which to base estimates.

As was pointed out in the beginning, the whole question is an extremely complicated one and requires the fullest discussion for even a fair understanding of the nature of the case, and I sincerely hope that such a discussion will be forthcoming.

Maryland Electric Railways Bond Issue.

The Maryland Electric Railways Company, of Baltimore, Md., has arranged for the sale to Brown Brothers & Company, New York city, of $750,000 of the $1,000,000 first mortgage five per cent gold bonds of the Baltimore & Annapolis Short Line, dated August 1, 1906, and due August 1, 1946, an underlying issue of the Maryland Electric Railways Company. The proceeds will be used to electrify the Short Line division.

Illuminating Engineering Society.

A meeting of the New York section of the Illuminating Engineering Society was held on Friday evening, May 10, at the Edison Auditorium. In the absence of the president the meeting was called to order by L. B. Marks, who introduced the lecturer of the evening, G. H. Stickney, electrical engineer, General Electric Company, who delivered a discourse upon "Color Values of Artificial Illuminants." This was largely made up of demonstrations upon the screen showing various color effects and effects produced by different classes of diffusers and illuminants. The latter included the Welsbach mantle gas lamp, the incandescent lamp, the enclosed arc lamp and the Nernst lamp.

The discussion was opened by Leon Gaster, who was the delegate of the Faraday Society, of Great Britain, to the recent dedication ceremonies of the Engineering Societies Building. Mr. Gaster briefly pointed out how important a careful study of problems in illumination is, as was well demonstrated by the lecture just delivered. He spoke appreciatively of the work of the society, and said that upon his return to England he was going to make a strong effort to have the work taken up there in some effective way.

He called attention to some hereditary peculiarities which have been noticed in connection with color blindness. It had been found that in many cases this defect is transmitted to male descendants only. A daughter of a color-blind person, although she may not herself be color blind, may transmit this effect to her male descendants.

D. McFarlan Moore reviewed briefly the work which had been done to control the quality of light given off by an illuminant. There are two methods of doing this—one by producing the quality of light desired; the other by taking what is produced and modifying this by shades. The first is, of course, the more scientific and efficient. Mr. Moore described the different kinds of light given by the Moore tube, dwelling particularly upon the pure white light which is radiated when carbon dioxide is used in the tube. It had been found with such tubes that expert color matchers could detect no difference when working by this light and by daylight. He suggested that light of this kind would be proper for use as a standard, because of its close resemblance to daylight.

Otto H. Foell spoke briefly of the work being done by the Pittsburg section, and extended a cordial invitation to all members of the New York section to attend any meetings of the former.

G. L. Hunter discussed the importance of the color of the walls and furniture of a room, and the effect which these have upon the general illumination. A slight tinge of orange on the walls makes the room seem more cheerful and brighter, although a better illumination may be secured with a paper tinted a light green when using a Welsbach mantle.

H. H. Seabrook said that most eyes see six colors, though some see seven. Color blindness can not be helped, and there is no need of trying to educate people to see correctly who have positive color blindness. The next problem is partial color blindness. One per cent of women are partially color blind and five per cent of men. This is a condition which can be cured by education. It is important to realize that the question of matching colors is frequently one of knowing what the color is. He referred briefly to the effect of the actinic rays upon the eye, noticed particularly at high altitudes or on snow fields. This may be prevented by the use of proper glasses.

T. J. Little, Jr., said that the quality of light given by the Welsbach mantles is well under control. Usually the light is more or less tinted, but a whiter mantle may be produced by increasing the content of cerium. A mantle with a content of 0.75 per cent of cerium produces this effect.

E. Y. Porter said he thought that an illuminating engineer should be about nine-tenths oculist, because the effect of illumination upon the eye is the most important feature. Artificial light is employed merely to see by, and if in doing so the eye is injured or deceived, the end sought for is defeated. He thinks it is more important to tone down the intensity of light than to tone down the color. If the light does not glare, the actual injury to the eye will be slight within a wide range of colors. White light is all right if not too bright, and eventually this will generally be adopted, as it most nearly approaches daylight.

In closing the discussion, Mr. Stickney regretted that he had not had more experience with the Moore light. There are certain places, such as restaurants and houses, where he does not think it is desirable to employ white light, as the yellow light is more satisfactory, at least at the present time.

Replying to a question why certain authorities recommend yellow light for reading, he said that it had not been shown that it was the color of the light that was appreciated, but it seemed more likely that it was the diffused character of the light which was so agreeable.

Secretary P. S. Millar, of the New York section, announced that at a meeting of the council held in the afternoon it had been decided to accept an invitation extended by the city of Boston to hold the convention of the society in that city during Old Home Week, the latter part of July or the early part of August. This invitation had been extended both by the mayor of Boston and the Boston section.

The meeting was then adjourned.

PRELIMINARY PROGRAMME OF THE THIRTIETH CONVENTION OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

WASHINGTON, D. C., JUNE 4, 5, 6 AND 7.

The following preliminary programme has been announced for the thirtieth annual convention of the National Electric Light Association, which will be held at the New Willard, Washington, D. C., June 4, 5, 6 and 7:

MONDAY EVENING—JUNE 3.

Opening of the exhibition of the Associate Members—eight o'clock.

Reception, followed by dancing—nine o'clock. The reception will be held in the meeting room, music being furnished by a section of the Marine Band. Both the exhibition hall and meeting room are on the tenth floor of the New Willard Hotel.

TUESDAY, JUNE 4—OPENING SESSION, 10 A. M.

Convention called to order by the president.

Address of welcome.

President's address.

Announcements by the secretary.

Report of Committee on Progress, T. Commerford Martin.

"Accidents," Paul Lüpke.

"The Effect of Frosting Incandescent Lamps," Dr. Edward P. Hyde.

"Need for an Accurate Maximum Demand Meter for Measuring the True Energy of Polyphase Service." Discussion led by Louis A. Ferguson.

EXECUTIVE SESSION.

Report of the Executive Committee, by the secretary.

Report of Committee on Membership Dues, W. H. Gardiner.

Report of Committee to Revise Constitution and By-Laws, Samuel Scovil.

AFTERNOON SESSION—2:30 P. M.

"Legal Justification for Differential Rates," Geo. Whitefield Betts, Jr.

"Recent Developments in Mercury Rectifiers," Frank Conrad.

"Report of Committee on Standard Rules for Electrical Construction and Operation," Ernest H. Davis.

"Report of Committee on the Fire Hazard of Electricity," C. E. Skinner.

"Report on Insurance and Kindred Matters," W. H. Blood, Jr.

"Report of Committee on Electric Light Accounting," H. M. Edwards.

WEDNESDAY, JUNE 5—10 A. M.

Report of committee on the present methods of protection from lightning and other static disturbances, Alex Dow.

"Recent Developments in Protective Apparatus," D. B. Rushmore.

"New Developments in Arc Lamps and High Efficiency Electrodes," G. M. Little.

Report of committee on electric heating and cooking, James I. Ayer.

"Electric Heating," C. D. Wood.

"The Future of the Gas Engine," Lewis Nixon.

"Producer Gas Engines for Central Station Work" (illustrated by stereopticon), Robert T. Lozier.

"The Frequencies of Flicker at Which Variations in Illumination Vanish," A. E. Kennelly and S. E. Whiting.

"Efficiency of Various Methods of Illumination" (illustrated by stereopticon), E. A. Norman.

Report of committee to consider specifications for street lighting, Dudley Farrand.

EVENING SESSION—8:30 P. M.

"Lightning and Lightning Protection," C. P. Steinmetz.

THURSDAY, JUNE 6—10 A. M.

Report of freight classification committee, Ernest H. Davis.

Report of committee on relations between manufacturers and central stations, Henry L. Doherty.

"Indefinite Candle Power Ratings in Municipal Contracts and the Experience of the Colorado Springs Electric Company."

"Recent Turbine Developments," W. L. R. Emmet.

"The Electric Automobile as an Adjunct to Central Station Load," H. H. Rice.

"Some Power Experiences," S. M. Sheridan.

"Municipal Ownership," Arthur H. Grant.

"Why We Failed in a Municipal Ownership Campaign," Glenn Marston.

"Italian Methods of Charging for Electric Current," Guido Semenza.

"Report of Membership Committee," J. Robert Crouse.

Report of committee on relations with local associations, S. R. Bradley, Jr.

Report of committee on the grounding of alternating-current secondary circuits, W. H. Blood, Jr.

EXECUTIVE SESSION—8:30 P. M.

Report of committee on rates and costs, R. S. Hale.

Report of public policy committee, Everett W. Burdett.

FRIDAY, JUNE 7—COMMERCIAL OR NEW BUSINESS DAY—10 A. M. AND 2 P. M.

"Scope and Character of Papers and Discussion," W. W. Freeman.

THE COMMERCIAL FIELD.

Report of National Electric Light Association cooperating committee, W. W. Freeman.

"Cooperative Commercialism in the Electric Field," J. Robert Crouse.

"Possibilities of Commercial Development," Henry L. Doherty.

"New Business—How to Get It—How to Keep It," F. M. Tait.

"New Business Results Demonstrated in Cities of All Sizes," J. E. Montague.

Discussion.

QUESTIONS OF POLICY.

"Sales Policy in Combination Gas and Electric Companies," F. A. Willard.

"The Electrical Jobbers and Dealers' Cooperation in Business-Getting," R. V. Scudder.

"Cooperation of the Electrical Trade Papers in Business-Getting," F. W. Loomis.

Discussion.

WIRING.

"How to Get the Old Buildings Wired," F. H. Golding.

"How to Get the New Buildings Wired," J. Sheldon Cartwright.

"Cooperation of the Electric Contractor in the Wiring of Buildings," James R. Strong.

Discussion.

THE SOLICITOR.

"Sizing Up the Territory—Preparing the Lists of Prospective Customers," George Williams.

"Qualifications of Solicitors for Different Classes of Business," F. W. Frueauff.

"How to Measure Results and Pay Solicitors," Leon H. Scherck.

"Increasing the Efficiency of the Sales Force," J. D. Kenyon.

"Value and Use of Solicitors' Handbook," R. S. Hale.

Discussion.

Adjournment for luncheon.

ADVERTISING.

"A Balanced Advertising Programme," Ralph Richardson.

"Advertising Results Demonstrated in Cities of All Sizes," E. S. Marlow.

"How to Make the Most of Newspaper Advertising," A. D. Mackie.

"Measuring the Results of Advertising," M. S. Seelman, Jr.

"Value of the Service of the Advertising Agency or Specialist," Lawrence Manning.

"Display Room and Demonstration as Business-Getters," E. R. Davenport.

"New Business by Indirect Methods," L. D. Mathes.

Discussion.

LIGHT.

"Illuminating Engineering as an Aid to Securing and Retaining Business," C. F. Oehlmann.

"Methods of Securing Residential Business," R. W. Hemphill.

"Cooperative Lighting of Streets by Merchants," H. J. Gille.

"Methods of Securing Sign, Window and Outline Lighting," Homer Honeywell.

Discussion.

POWER.

"Methods of Securing Power Business," Geo. N. Tidd.

"Catering to Power for Automobile Charging," R. W. Rollins.

"Establishing Day Circuits in Towns of 10,000 Population and Under," F. H. Plaice.

Discussion.

HEATING.

"Methods of Exploiting Electric Heating Devices," T. K. Jackson.

Discussion.

"Review of Advertising" (illustrated with stereopticon slides), C. W. Lee.

"Memorial," T. C. Martin.

Report of the nominating committee.

Election of officers for the ensuing year.

Adjournment.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

A New Electrometer for Static Charges.

A description is given here by Theod. Wulf of a new electrometer designed for measuring high potentials. The deflecting leaves are of light metal foil suspended in the usual manner, but connected together at their lower edges. At this point a light weight is attached. When charged, the two leaves bow out from one another, the distance by which they are separated varying with the potential. A curve of values shows, for a particular instrument, that the characteristic is practically a straight line from fifty to 250 volts. An advantage of this type of instrument is that the two portions of the leaves which are viewed through the telescope remain nearly parallel, so that the scale may be read up to 150 divisions. With the ordinary type of electroscope, with the leaves attached only at their upper edges, but thirty scale divisions may be read accurately.—*Translated and abstracted from Physikalische Zeitschrift (Leipsic), April 15.*

Statistics of the Electric Generating Stations in Germany.

A summary is given and a graphical diagram showing the growth of the electrical supply stations in Germany from the year 1894 to and including 1906. In the former year there were only 148 stations, with an output in incandescent lamps of 493,801; in arc lamps, of 12,357; in motors, of 5,635 horse-power. The apparatus for supplying light had an aggregate rating of 30,869 kilowatts; for power it was 5,072, the total being 35,941. The growth during this period of twelve years has been regular, and at a slightly increasing rate. In 1906 the total number of stations supplying electric power was 1,338. The number of connected fifty-watt incandescent lamps was 8,240,596. There were 154,913 arc lamps, and motors with an aggregate output of 377,838 horse-power. The generators for lighting were rated at 489,485 kilowatts; for power, at 340,056 kilowatts, the total being 829,541 kilowatts. A list of the principal cities is given, showing the size of the equipment in each.—*Translated and abstracted from Elektrotechnische Zeitschrift (Berlin), April 18.*

The Application of Electricity to Ordnance Work in the Navy.

The present backward position of the British navy, so far as electrical operation of gun turrets is concerned, is due to the drawback that only the men with a lifetime of experience behind them are allowed control; consequently there is a backward position in comparison with the United States, or even Russia. These men have brought their hydraulic gear to such a pitch of perfection that they can scarcely improve it. They are naturally fond of it, and to them water power represents all that is desirable. Weight plays a most important part in the design of gun gear, and, in fact, of any gear on board ships of war. Contrary to expectation, the electrical gear will not be much, if any, heavier than hydraulic gear. It is possible and probable that the weight of the electrical gear may be considerably reduced in future practice. All operations which require motors show a heavy, but momentary, load on starting up, and a very small demand afterwards. This is the case in ammunition hoists, rammers and breech mechanism, where a large mass has to be started and accelerated. The electric motor, of course, scores here unmistakably. A moderate horse-power may be installed, trusting to the motor to take care of the overload on starting. This is not so with hydraulic presses. The press must have sufficient power behind the piston to take the highest load. No overload is possible. For returning again after recoil, it must be admitted that at present the hydraulic system, by means of which the gun is brought back to the firing position by a press, is superior. Up to the present time the electrically operated mounting has been fitted with long springs subdivided and encased. It is more than likely, however, that when electrical power has received the same close attention and long-continued thought which has been accorded to the hydraulic system, some more reliable and less bulky means will be devised. On the score of economy electricity holds the field, being generated by efficient sets and not subjected to the same losses in transmission. Given a fair test, electricity will more than hold its own in competition with the older power. Up to the present time no such test has been made, but in all probability it will be in the near future.—*Abstracted from the Electrical Times (London), April 18.*

Fleet Telephony.

A brief description is here given by Commander Bradley A. Fiske, U. S. N., of certain tests which he conducted to establish telephone communication between vessels of a fleet. The chief object of this was to enable a fleet to maintain its formation and course during fogs. For this purpose the present system of signaling by whistles is not satisfactory, as it is slow and uncertain. Wireless telegraphy could not be employed, since this would not be allowable during war, and therefore should not be permitted at other times. The plan suggested was for the leading vessel, upon the approach of a fog, to throw over a buoy to which was attached a telephone cable. This was picked up by the second vessel in the line and attached to permanent circuits installed on it. This vessel also throws over a similar buoy and cable, as do all the other vessels in the fleet, with the exception of the last one. By means of these cables telephone communication is to be maintained between all the vessels. To allow for slight changes in position a small reel is carried on the bow of each vessel, which takes in the slack or pays out cable, as may be necessary. Two attempts were made to carry out this plan, but the appliances obtainable were not satisfactory, as the cable used was patched up from short pieces. This, however, enabled communication to be maintained between two vessels, while steaming, for a short time, when the same cable was also unsatisfactory, for although the cable was supported by a signal halyard, a break occurred somewhere in the electrical circuit. It was found possible, however, for the two vessels to continue on their course without breaking the halyard. This seems to prove that with a telephone cable of equal strength the same results would have followed and communication would have been maintained. It is suggested that the experiment would cost but little to try, and if successful the plan would be of much assistance to the navy.—*Abstracted from the Proceedings of the United States Naval Institute (Washington), March.*

Problems in Commutation.

An instructive discussion of the problems encountered in designing and operating commutators is given here by Miles Walker. The troubles which may be encountered are mechanical and electrical. The former are caused by the commutators not running true, or not being perfectly cylindrical. If the commutator be not true it is desirable to have parallel motion of the brushes. Any slight swiveling of the brushes, such as takes place with pivoted holders, will always cause sparking. The simplest and best plan is the sliding box type of holder; but, when used, care should be taken to secure a good but easy fit. Chattering frequently gives trouble, and the cause can not always be located. To avoid it as much as possible the brush-holder should be very rigid, and the pressure upon the brush sufficient. With high-speed commutators it is frequently found that the pressure required to prevent chattering is several times greater than that necessary to give good contact. The important point to study is the potential drop between brushes and commutator. This varies, but not according to a straight-line law, as it tends to become uniform for great current densities. At forty amperes per square inch the voltage drop is about one for metal to carbon, and about 0.9 for carbon to metal. If the current density be doubled, the drop is not much more. This phenomenon is not understood, but it seems as though there were a very short arc between the carbon and the metal. The problem of overcoming the effect of armature reaction is discussed, it being pointed out that this can be completely compensated for by placing field conductors parallel to each armature conductor. Commutating poles may also be used with good results. The advantage of this is that the strength of the commutating field is proportional to the current to be commutated. For high-speed machines most makers employ copper brushes, as it is difficult to get a carbon brush to run satisfactorily at such speeds; but the objection to the metal brush is that it wears the commutator more rapidly than carbon and is itself worn away. One effect sometimes not sufficiently provided against, and called here the "inductor effect," is the change in the magnetic field caused by the change in the number of teeth under a pole. If the teeth be few in number and comparatively large, this effect may become serious. It generally produces markings on the commutator at regular intervals. To avoid it the greatest care should be taken in spacing the poles, in the spacing of the brushes and in obtaining the proper form of air-gap. A useful tabulation is given which enables the cause to be located whenever the commutator is not operating properly.—*Abstracted from the Electric Journal (Pittsburg), May.*

Relays for the Control of High-Tension Switch Gear.

In this article C. C. Garrard discusses several points in connection with relays for high-tension switch-gear which have shown themselves to be important. When maximum inverse time-limit relays are employed the objects sought are twofold: to be able to set the circuit-breaking apparatus at such a value that it will protect the circuit from damage due to heating or overload, and yet prevent the circuit from being opened by every momentary rush of current inseparable from the operation of most systems. For this purpose there are two types of relay in operation. In both of these the time required to open the circuit varies inversely as the current. One of them, however, opens instantaneously if the current exceed a certain maximum value, while with the other the curve tends to become asymptotic, and the relay does not open for sudden short, but very heavy, current rushes. This property makes the second type of relay more valuable than the other, because with a series of relays installed to protect different sections of the line, a rush of current exceeding the maximum would open simultaneously all the relays of the first type; yet, with properly selected relays of the second type the proper sequence in opening would be followed. When connecting maximum-current relays to three-phase systems having the neutral point earthed, a triple-pole relay must be used, fed by three current transformers. On a three-wire, three-phase circuit—that is, one in which the neutral point is not earthed—only two current transformers are required, by reason of the fact that the current in one phase is always equal to the vectorial sum of the currents in the other two. Strictly speaking, it follows that a double-pole relay is sufficient protection for such a circuit, but, for mechanical reasons, it is better to install a three-pole relay. In selecting transformers for use with relays where heavy currents are flowing, care must be taken that the ratio of transformation does not vary too greatly for heavy loads. Such transformers are usually magnetically leaky, so that the ratio varies. It should always be specified that it does not vary appreciably up to at least 200 per cent overload. The general rule governing the installation of reverse-power relays is that they should be installed on all circuits which feed bus-bars. Generators should be equipped only with reverse-power relays. Maximum circuit-breaking apparatus should never be installed on them. The reverse-current relay should be set to operate at ten per cent of the normal rating of the generator. A lower setting is not desirable, since the circuit-breaker may thus be thrown out if the synchronizing be done rather carelessly. Various methods of connecting these relays are discussed.—*Abstracted from the Electrical Engineer (London), April 26.*

General Care and Management.

It may be safe to assume that the majority of owners of manufacturing or other establishments recognize, in a general way at least, the dangers arising from improper installation or arrangement of what may be termed the common or ordinary hazards usually met with. The danger of loss from fire is ever present, and in a general way the causes and conditions that will result in a fire are well known; but because, perhaps, some contributing factor or factors may be lacking or supposed to be, caution is cast to the winds and all possible chances are taken. The arrangement of the source of power is one of the most important factors in safeguarding an establishment. In most instances steam is used, and so well is the hazard recognized that standard requirements call for the separation of the power plant—at least of the boilers—from other parts of the establishment, either by providing a separated detached building, or a building thoroughly cut off from the main plant either by blank walls or by walls with openings protected by standard appliances, such as fire doors, shutters or wire-glass sash. Under no circumstances should any woodwork be permitted to come in contact with the boiler. The practice occasionally observed of using the top of a boiler temporarily for drying wet lumber is especially to be condemned. A boiler setting or covering may appear perfectly safe when new, but in the course of time cracks are bound to appear, the results of unequal shrinkage or settling, and will permit the passage of heat or sparks. The stacks should invariably be free and clear of all woodwork. Because a motor practically runs itself is no reason for sticking it in an out-of-the-way place or putting it under the charge of an incompetent person. Cleanliness is especially essential, as are properly enclosed fuses, proper arrangement of all apparatus and wiring, and the absolute freedom from any possibility of a short-circuit. No steam pipes should be allowed in contact with any woodwork or other combustible material, and should not, under any circumstances pass through any floor or partition without a metal collar or sleeve permitting circulation of air, so arranged as to prevent refuse from contact with the pipe inside of the space through which it passes.—*Abstracted from Insurance Engineering (New York), April.*

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

EDITED BY CHARLES A. PARKER.

What Advertising Does and Will Do for a Central Station.

Let the central station man who doesn't believe in advertising give a few moments of his time to reading this article carefully and understandingly.

Taking it for granted that you are pretty familiar with merchandising in general, you can consider, for instance, the fads that have been advertised.

Time was when the bicycles filled our paved streets, till the crossings were almost dangerous. Every place of business had to have a wheel room. They moved like a tremendous army into the business sections every morning—back again at night. Is such the case now? Do you get tangled up with a score of them when trying to make a passage of a business street these days?

No.

You're more likely to be bundled in a heap with electrically propelled cars.

The bicycle has passed. And why? Trusts began to form—demand was so great, no need to advertise, they said. The advertising ceased and the sale and use of them ceased.

Take that little fad, the air gun. Has it died out? Well, hardly! Advertising never ceased, kept everlastingly at it, so that, to-day, the demand has increased till the output of several great factories is tremendous.

Take the camera. Has that craze died out? Are there fewer kodak fiends loose to-day than yester-year? Ask the kodak man. They're multiplying with every season, till now the number of amateur photographers make up a great army.

Did these men cease in their persistency in advertising? You can bet they didn't.

Keep thinking, Mr. Doubter, and let such significant proof lay hold of your better sense, and deduce from the facts that inasmuch as advertising has sold everything from pickles, bicycles, air guns, health foods, etc., to clothing and automobiles, that it must be powerful enough to influence stores, factories and residences to use electricity.

Yes—good advertising will sell anything, if it is backed up with the right sort of business ability.

The merchants know the value of advertising. In fact, the thousands of department stores scattered all over the country are monuments to its effectiveness in building up business.

The up-to-date merchant wants all the good advertising he can get, because he has experienced that he can not make a safer or more profitable investment.

Every wise central station manager knows this and he knows that the strongest argument which he can use in closing contracts with merchants for electric illumination for interiors and show windows, as well as the electric sign, is its value from an advertising standpoint—to help sell goods.

A Pictorial Advertising Story.

But—does this same central station manager practice along the lines he preaches? A great many central station managers approve of advertising to the extent that they like to see merchants favor it, so far as illumination is concerned. Beyond that, advertising to them is a vague uncertainty, especially when applied to their business. But is it? It certainly is not, if properly done. The experience of the central stations who have used advertising to increase the sale of their current, proves this beyond question of a doubt.

If you have been running a plain card in your local newspapers, expecting that this alone will bring you business, more than likely you are still waiting for your hopes to materialize.

You must tell the people of your town How, When, Where and Why to use electricity.

If you are not enthusiastic about your service and its many advantages, how can you expect your fellow citizens to be?

You may have heard of the central station in a western city, whose advertising has been so convincing that it has increased its per capita sale of current from $3.00 to $10.00 and which has every undertaker in the city using an electric sign.

In another western city the retail merchants have been so thoroughly impressed with the value of illumination, as a factor in selling goods, that they have erected on both sides of the down-town streets a lot of three-arc poles. Not alone did they bear the expense of erecting the poles, but they are paying the lighting bills. The municipality itself maintains electric arcs in the middle of the streets.

Now, you may think the undertakers of your town too unimportant to bother with, and the business men too stingy to pay for special illumination of down-town streets. Nevertheless, there are all kinds of opportunities to get more business, and increase the off-peak load, as well as the peak, if you will only enthuse the people of your town to see the benefits accruing from a business standpoint by the use of electricity.

Don't overlook the fact that advertising creates a demand—that advertising is just as essential to electric plants as it is to other growing industries which have something to sell.

There are a lot of people in your city whose residences ought to be lighted by electricity—who have the means and desire to have things modern.

There are manufacturers using old types of gasolene engines, and some no power at all—who could be taught the economy and dependability of motor power.

There are stores insufficiently illuminat-

ed—whose keepers ought to know that by proper display, goods sell themselves.

Don't labor under the impression that advertising costs money. It makes money for you—if you do it right and are persistent.

It is not a question whether you can afford to advertise—but it's a question of whether you can afford not to advertise.

Commercial push is just as much a necessary asset to the success of a central station to-day as technical expertness and efficient commercial push is not possible without the aid of advertising.

The time is ripe for the central station to slip off its soft shoes; get down on to the ground like other successful business enterprises, and line up all the possible business in the town.

Under this general heading we shall present to our readers a series of bright, stimulating talks to solicitors, which, we believe, will prove valuable to managers of new-business departments in suggesting points which they can profitably bring out in their occasional meetings with the company's representatives.

We shall gratefully accept contributions and suggestions from any of our readers.

Can't you fellows infuse some will power and enthusiasm into your electrical solicitation?

Do the best you can, anyhow.

And by doing the best you can,

Do the *best you can.*

Don't pull the wool over your own eyes, whatever you do.

Don't drop into the cigar store when you've worked half-heartedly most of the day and try to convince yourself that "you've done the best you could."

You haven't.

And you know hanged well, you haven't.

And when you account to yourself honestly for every hour spent, you'll admit to yourself you haven't.

Start out to-morrow, "*right.*"

You can if you only will.

Don't let it be said, you're weak-minded.

Don't let it be thought that you can't make good.

You can and you *will.*

Get more enthusiastic over your subject and you'll find it's infectious.

Try to convince your prospect as thoroughly as you yourself are convinced.

Then shove your contract under his nose already prepared and filled out—just waiting for his signature,

And you'll get it—

You can't help but land your man if he's been interested enough to listen to you.

The time invariably comes when he'll struggle some, and you'd have to be ready with all the fine points of your subject, so that you can floor him every time he breaks out.

Have your plan all ready so that you can meet him on every point, and when he hesitates, don't push him—jump on him.

It will be our endeavor, from week to week, to present in this department brief notices of activities among the central stations, as gathered from men who are in the field and, consequently, in close touch with the progress of the new-business idea and its acceptance by central station managers. Contributions to this department are solicited, and will be received with much appreciation by the editor.

If you are doing something a little better than or different from the other fellows, and think it would make interesting reading to ELECTRICAL REVIEW readers, send in your schemes and plans. They will be gladly received.

Address all communications to Charles A. Parker, care of the ELECTRICAL REVIEW.

How Auburn Woke Up.

Some few months ago a gentleman by the name of M. C. Turpin became general superintendent and manager of the Auburn Light, Heat and Power Company, Auburn, N. Y.

From the minute Mr. Turpin sat down to his mahogany desk and began to pilot the business of this concern, his office force and fellow workers realized that things were going to move lively. He first instilled in them enthusiasm and got them booming electricity and its advantages among all their friends and acquaintances. He himself then began to get acquainted with his townsmen, and it was not long before this wide-awake hustler became the most popular man in the city of Auburn. His genial, whole-souled way and magnetic personality soon won for him and the company he represented a host of friends.

If you did not know him and could see him mingling with his fellow citizens you would think he was either a New York legislator or a prospective candidate for mayor. Mr. Turpin realized when he took hold of the reins at Auburn that he had a great many difficulties to surmount. A hustling gas company was confiscating business that would ordinarily flow to the electric plant. They were continually doing things and kept the electric company busy finding out what they intended to do next.

Mr. Turpin also had a competitive electric plant to contend with. As a whole, however, Auburn was pretty nearly dead in an electrical way, and Mr. Turpin realized that his opportunity had come to make a showing.

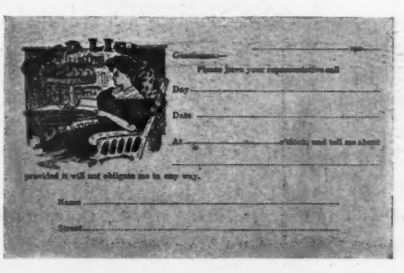
So far, considering the handicaps he had to meet, he has been very successful. With lots of good business ability and hustle, he has things moving, which indicate that Auburn will soon be known as one of the electric cities, where gas is down and out, as far as lighting is concerned.

By assisting his merchant customers in obtaining the best lighting effect for their show windows and interiors, by installing some new electric signs about the city, and by working in harmony with contractors, architects and those who are building new houses, he has added considerable new business and has proved to the public that it pays to do business with him.

The Auburn Light, Heat and Power Company also realized that to line up the greatest amount of business, to create the most friendly impression with customers and prospects, and to get down close to the people, that a direct-by-mail advertising campaign was necessary. So it is issuing a monthly bulletin and is sending out to merchants once every month a special piece of advertising to drive home the advantages of the electric sign, show window and interior lighting of stores and business places.

Although this service has been in vogue for only a few months, results show that it will, without doubt, prove very profitable advertising.

This electric sign or store advertising service consists of exceedingly attractive

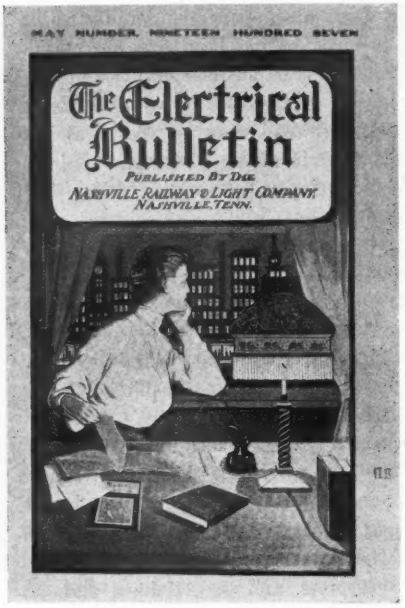

Please have your representative call
Day
Date
At o'clock, and tell me about
provided it will not obligate me in any way.
Name
Street

The return postal card is enclosed with every piece of advertising, except the mailing cards, of the Nashville Railway and Light Company, Nashville, Tenn. They have been found to be extremely useful in securing definite appointments for solicitors.

and convincing series of booklets, folders, novelty folders, mailing cards and personal letters. Each piece drives home a good, strong point or so. The illustrations are built on the "show me" order. The reading matter is logical—not tedious—

but terse and readable. The entire campaign is especially planned to get the merchant telephoning, writing or calling on them for information—making definite appointments with the company's representatives.

This company's bulletin is six by nine



Cover of one of the monthly bulletins issued by the Nashville Railway and Light Company of Nashville.

inches and consists of sixteen pages. It is well gotten up, illustrated and handsomely printed in two colors. On the front cover there appears each month an entirely different cover design, which adds considerably to the attractiveness of the bulletin. The inside pages are taken up with reading matter and illustrations relating to electric light for the home, store, office and factory; electric fans, electric heating devices (irons, curling-iron heaters, heating pads, chafing dishes, etc.), electric motors (for domestic use and for factories, stores, etc.), electric signs, window displays, etc. On the back page appears a special advertisement calling attention to some special inducement the company has to offer or something they wish to emphasize. Each bulletin contains a return postal, and they are sent out in attractive envelopes.

We congratulate the Auburn Light, Heat and Power Company on its advertising and on having such an enterprising, resourceful, yet up-to-date superintendent, and we believe that his unassuming personality and efforts will prove very profitable to his company.

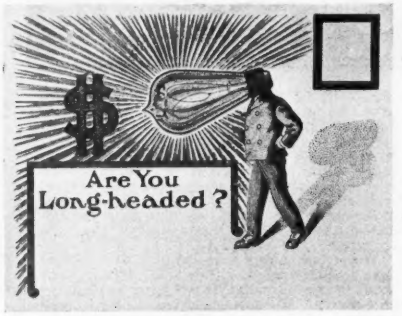
It is indeed refreshing to note the mixture that has been obtained in Nashville, Tenn., where real old southern courtesy and big-heartedness keep lockstep with an enthusiasm and a zeal for new business—a combination which is positively irresistible.

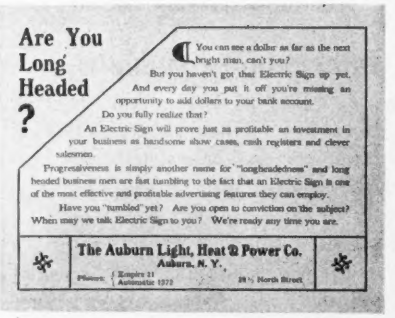
While perhaps this proverbial trait of character is "in the blood," there is none the less credit due the Nashville Railway and Light Company for exercising it in a business way to increase the revenue from the manufacture of current.

And it makes everybody feel good.

There is no reason in the world why business all over this country can not be carried on with the same exhibition of true courtesy and good feeling.

There is no attribute so coercing, no characteristic so compelling as this gentle




Are You Long Headed ?
You can see a dollar as far as the next bright man, can't you?
But you haven't got that Electric Sign up yet.
And every day you put it off you're missing an opportunity to add dollars to your bank account.
Do you fully realize that?
An Electric Sign will prove just as profitable an investment in your business as handsome show cases, cash registers and clever salesmen.
Progressiveness is simply another name for "longheadedness" and long headed business men are fast tumbling to the fact that an Electric Sign is one of the most effective and profitable advertising features they can employ.
Have you "tumbled" yet? Are you open to conviction on the subject? When may we talk Electric Sign to you? We're ready any time you are.
The Auburn Light, Heat & Power Co.
Auburn, N. Y.
Phone: { Empire 11 / Automatic 1273
39½ North Street

Showing the two sides of a strong mailing card of the Auburn Light, Heat and Power Company, Auburn, N. Y., sent to prospective sign users.

art of being courteous—and none costs so little. You may wager to the extent of your well-filled purse that, other things being equal, the man who can command this attitude of civility and respect will win out.

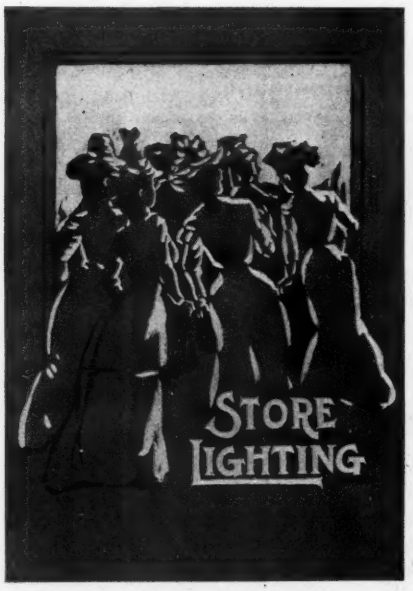
Well, Nashville has it, and no better proof of its effectiveness can be found than the immense increase in business experienced by this live concern.

J. P. W. Brown, superintendent of lighting at Nashville, has proven his unerring business judgment in the selection of James E. Carnes as head of the hustle department. Both these gentlemen have put their shoulders to the new-business wheel, and are driving it with the impetus of an electric motor.

Mr. Carnes has about nine good, live solicitors continually hustling for business, and they are not left unaided, as the advertising bee-hive has swarmed and found a comfortable home in the bonnets of the entire organization.

Messrs. Brown and Carnes are nothing if not up to date. Their tactics exhibit the prowess of sterling business and personal character. Weighed in the balance, they are central station heavyweights. They are men after our own heart. The system inaugurated is one of the most perfect a central station could employ. During the past year it has gone after the stores and residences with loaded weapons. With decided regularity a series of attractive and argumentative cards, folders and booklets have been sent direct through the mails to prospective users of current. One has followed the other until the telling force of the message has taken deep root, and he opens up with a question or two on this point or that, and is left to the tender mercies of the solicitor.

This year it is mailing to its friends—and those it would like to make friends—a monthly house-organ known as the



Novel booklet sent out by the Nashville Railway and Light Company to a list of merchants. The cover of this booklet was printed on embossed parchment. It made a very attractive piece of advertising.

"Electrical Bulletin," a decidedly attractive and educational publication which finds warm welcome in the hands of those fortunate enough to receive it. The influence of this bulletin is widespread and has cause to be looked for as eagerly as the other monthly periodicals for which subscriptions have been paid. It is replete in every issue with ginger talks on important electrical themes, telling what

the most aggressive inventors have done for the good of the cause, and how much comfort, economy and luxury is in the store for those who live their lives and conduct their businesses electrically. Here and there are pithy epigrams, short tales

REFINED VAUDEVILLE
"The Public Pays for Every Electric Sign"
It will pay for yours.
Auburn Light, Heat & Power Co.
Auburn, N. Y.
A SAFE INVESTMENT
An Electric Sign

Novelty folder of the Auburn Light, Heat and Power Company, Auburn, N. Y., which forms part of its direct-by-mail advertising service to stores and business places.

which paint a moral, and funnyisms. It is the backbone of Nashville advertising.

Prospective power users are being worked over in Nashville, and if great numbers of them don't come into the fold they will do so before long, or else live on

tion amounting to 1,235 horse-power of three-phase motors.

Recently this company carried on a most successful campaign of free wiring. Just how successful it was may be devised from the fact that the scheme was discontinued after a few months, the results desired having been realized. There has been no let-up, however, in getting after business.

The company operating both the railway and light business has a remarkable opportunity to work from both ends.

Nashville, so far as is known, is the only city in the world where such a scheme is operated. It has met with great success. Plans are now under way for the improvement of this station, and it is proposed to place the lighting department right at this point. As this company takes its own medicine and advertises with electric light, such a change will mean an ever-increasing interest in things electrical. Nashville is a fortunate city.

The Exhibit of the Allis-Chalmers Company at Jamestown.

While Allis-Chalmers Company's exhibit space at the Jamestown Tercentennial Exposition (Section No. 8, Machinery and Transportation Building) does not contain specimens of all lines of its products, but only of a few products, these are of standard sizes and design such as are used in thousands of installations the country over for practical every-day service.

This is particularly true of the electrical machinery shown and the Reliance engine which is well known to power-users everywhere. Nearly half of all the Reliance engines thus far installed have

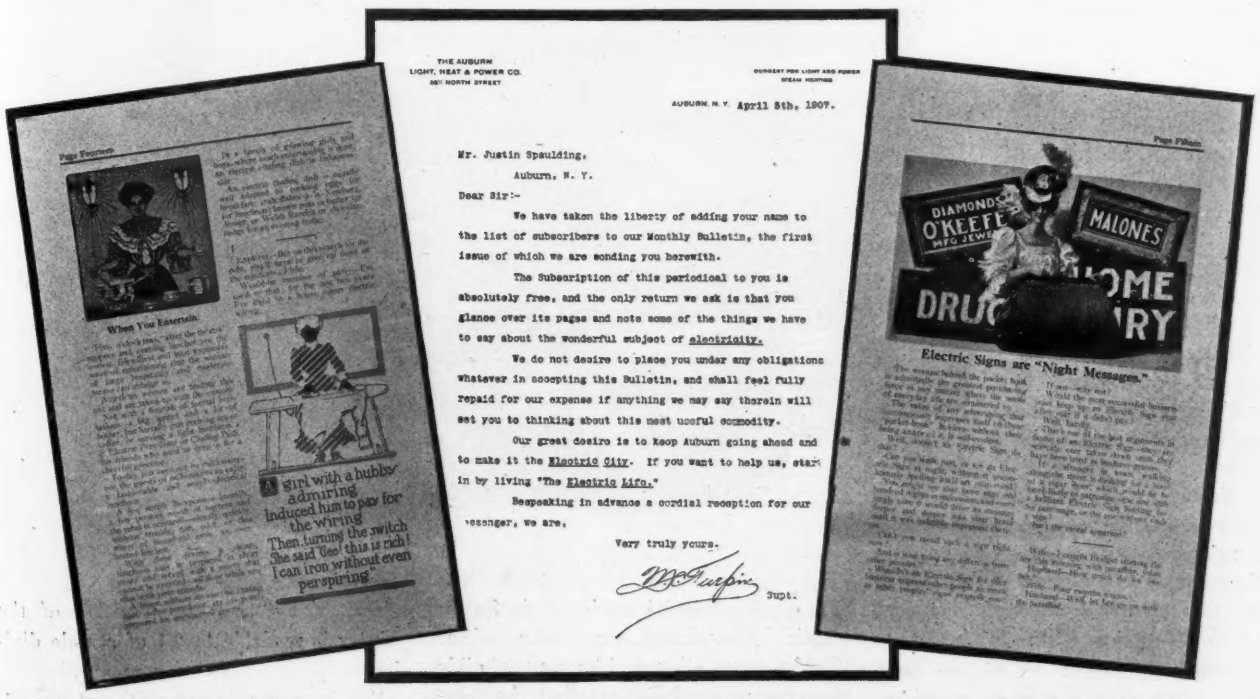

When You Entertain
A girl with a hubby admiring induced him to pay for the wiring Then turning the switch She said "Gee! this is rich! I can iron without even perspiring."
THE AUBURN LIGHT, HEAT & POWER CO.
AUBURN, N. Y. April 5th, 1907.
Mr. Justin Spaulding,
Auburn, N. Y.
Dear Sir:-
We have taken the liberty of adding your name to the list of subscribers to our Monthly Bulletin, the first issue of which we are sending you herewith.
The Subscription of this periodical to you is absolutely free, and the only return we ask is that you glance over its pages and note some of the things we have to say about the wonderful subject of electricity.
We do not desire to place you under any obligations whatever in accepting this Bulletin, and shall feel fully repaid for our expense if anything we may say therein will set you to thinking about this most useful commodity.
Our great desire is to keep Auburn going ahead and to make it the Electric City. If you want to help us, start in by living "The Electric Life."
Bespeaking in advance a cordial reception for our messenger, we are,
Very truly yours.
Supt.
DIAMONDS
O'KEEFE
MALONES
Electric Signs are "Night Messages."

Illustration showing two of the inside pages of the April bulletin of the Auburn Light, Heat and Power Company, Auburn, N. Y., and also the letter which went with it. This was the first number of its bulletin and the letter went with it, to introduce it to the people.

with the knowledge that they're bringing up the rear.

The same competent system of direct-by-mail advertising and good solicitation is increasing the power business. The company has just connected up an installa-

The Nashville Railway and Light Company has done a unique thing. It operates the railways of this hustling southern city, and has adopted a central transfer station, through which all cars pass. This is the only transfer point in the city, and

generators. Allis-Chalmers type "AB" alternators, similar to the one on exhibition in Machinery Hall, are especially suited for comparatively small plants where a belted generator of not exceeding 150-kilowatt output is required.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

THE MULTIMETER.

A NEW GENERAL TESTING INSTRUMENT FOR DIRECT-CURRENT MEASUREMENTS.

The Multimeter, a new instrument manufactured by the Weston Electrical Instrument Company, of Waverly Park, Newark, N. J., should prove a source of great satisfaction to many persons interested in the making of electrical measurements, who have been desirous of acquiring a comprehensive testing instrument for direct-current circuits. This instrument is so designed that it will quite accurately serve the purpose of a direct-current voltmeter, milli-voltmeter, ammeter, mil-ammeter, ohmmeter, ground detector and Wheatstone bridge, and is particularly valuable in view of the fact that when serving as a voltmeter, millivoltmeter, ammeter or milammeter it nearly equals the accuracy obtained with any of the separate standard portable instruments bearing those names, having substantially the same ranges.

The scope of the measurements that may be made with the Multimeter is exceptionally large and the statements with regard to its reliability made by the manufacturer should make it prove to be a most valuable adjunct to any testing equipment.

A reference to the illustration (Fig. 1) will indicate that the right half of the carrying case contains a three-dial Wheatstone bridge having a set of five ratio coils, together with a battery of twelve cells. The left-hand portion of the case contains the indicating instrument, constructed in exact accordance with the well-known Weston portable direct-current instruments, except that it is provided with a special moving coil in order that it may better meet the several requirements of the combination, of which the indicating instrument forms a part.

The scale of the instrument has 160 scale divisions, having a zero placed at ten divisions from the left-hand extremity, so that when the instrument is used as a galvanometer in conjunction with the Wheatstone bridge both positive and negative deflections may be obtained.

The compartment at the rear of the instrument contains three shunts, with capacities of 1.5, 15 and 150 amperes, mounted upon a single base, and provided with a pair of flexible cables of six feet in length. The shunts are constructed of Weston patent alloy, and have a negligible temperature coefficient, so that the combination of the instrument and shunt is practically free from errors due to temperature changes.

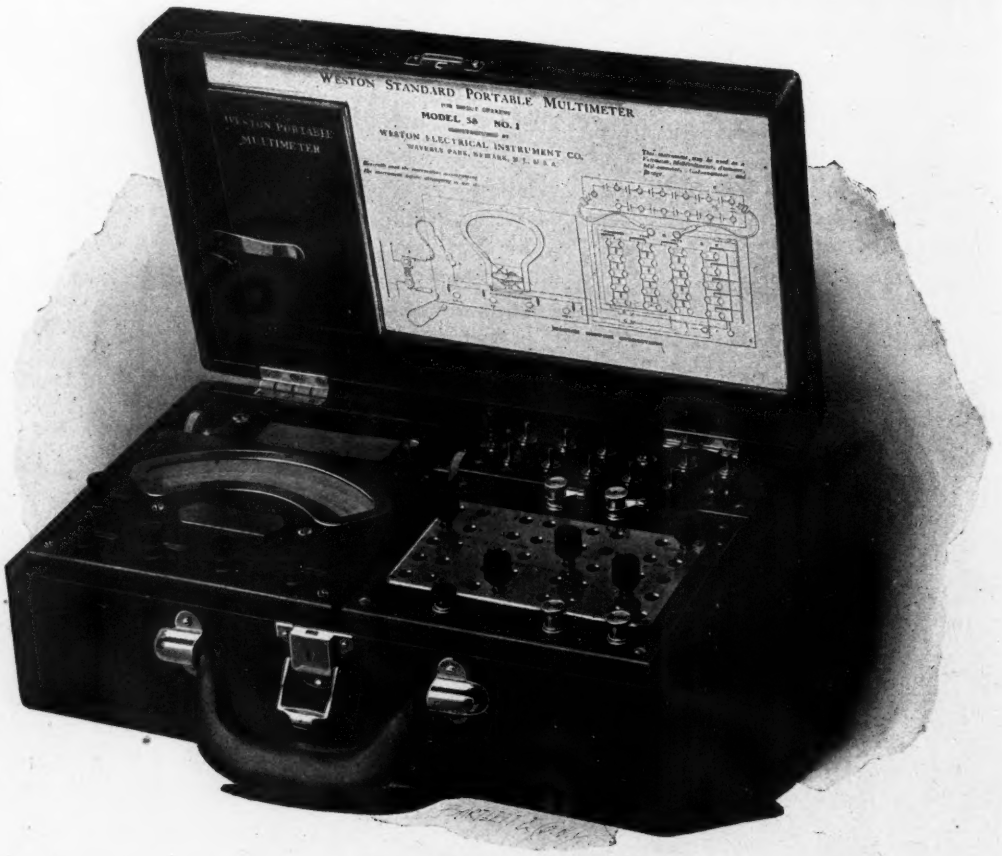


FIG. 1.—THE "MULTIMETER."

The Multimeter when used as a voltmeter has the following ranges:

0 to 75 milli-volts,
0 to 3 volts,
0 to 150 volts,
0 to 750 volts;

and when used as an ammeter has ranges of

0 to 15 mil-amperes,
0 to 1.5 amperes,
0 to 15 amperes,
0 to 150 amperes.

On the lowest range for potential measurement each scale division has a value of 0.5 of a milli-volt, and on the lowest range in amperes each scale division represents 0.1 of a mil-ampere (0.0001 ampere). It is further interesting to note that the pointer of the moving coil has a knife-edge tip, and by means of its reflex in the mirror of the scale the position of the pointer is readable to 0.1 of a scale division.

For current measurements not exceeding fifteen mil-amperes the instrument may be directly connected in circuit without a shunt and used as a mil-ammeter, because the current required to produce a full scale deflection is fifteen mil-amperes for all ranges. The measurement of larger currents must be made in connec-

tion with the shunts best adapted for the capacities.

In all measurements of potential difference the binding post marked plus is common to every range. The other connection to the instrument is to be made at the most suitable of the binding posts

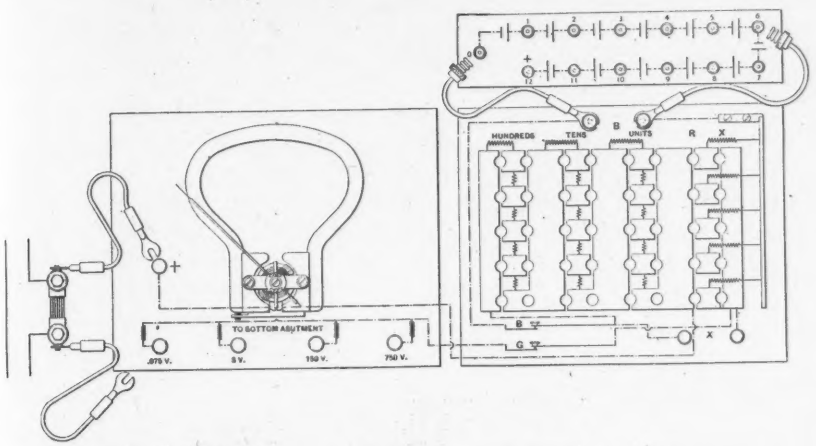


FIG. 2.—DIAGRAM SHOWING CONNECTIONS, WESTON MULTIMETER.

marked 3, 150 and 750 volts, in accordance with the assumed approximate value of difference in potential to be measured.

The sensibility of this instrument is shown by the following table:

Volts.	Resistance of Range in Ohms.	Value per Scale Division in Volts.
0.075	5	0.0005
3.	200	0.02
150.	10,000	1.2
750.	50,000	5.

The Wheatstone bridge (Fig. 2), which forms part of the Multimeter, consists of a rheostat with three groups of coils, ad-

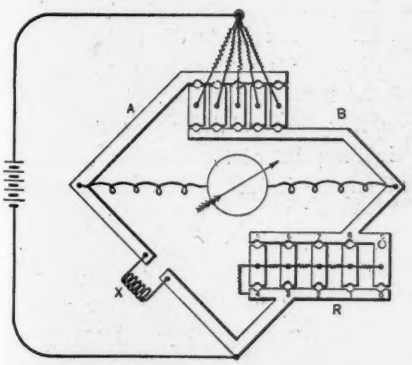


FIG. 3.—THE WESTON BRIDGE.

justed respectively to units, tens, hundreds, aggregating 999 ohms and a set of five ratio coils.

The actual adjustment of the resistance in the three decades of the bridge is made to within one-quarter of one per cent, and the adjustment of the ratio coils is made within one-tenth of one per cent. The condition that makes it unnecessary to adjust within broader limits of accuracy on the bridge may be understood when the comparatively low sensibility of the instrument when serving as a galvanometer is borne in mind. It is of interest to note that many novel features have been embodied in the construction of this bridge; compactness and durability being combined with a convenience of arrangement, and an exceptionally high insulation resistance. The entire system of conductors and plug receptacles are placed beneath instead of above the rubber top, which form of construction serves to prevent any reduction of the insulation resistance because the under side of the rubber plate is not exposed to the deteriorating effect of light, dirt and moisture. A most important characteristic of this bridge is that conductors of large ratio are employed throughout, and that their arrangement is compact, and all temporary or imperfect connections are avoided. The precision of fit of the five plugs that are furnished make the zero resistance of the instrument—the manufacturer claims—less than that of any other portable bridge manufactured. A single push-button is the only visible portion of the double successive contact given, by means of which the galvanometer and battery circuits are made and broken. The separate compartment provided for the battery contains twelve cells connected in series and fastened to a hard rubber top. Any one of these cells may be easily removed in case of necessity, and a single or greater number of cells may be used in accordance with the requirements of the case.

From even a brief analysis of this instrument, it will be seen that its range of usefulness is almost infinite. It is not possible, of course, within the scope of this article to more than indicate the number of tests which can be made, such as the measurement of current strength with the milli-ammeter, resistance measurements, instrument checking, insulation tests, trouble work, etc.

In the Weston bridge the possibility of any inaccuracy due to imperfect contacts has been almost entirely eliminated. The scheme of this bridge will be readily understood by referring to its diagrammatic arrangement (Fig. 3). Any oil in the bridge arms may be used on either the A and B side by the use of a plug. Only one decade of the rheostat is shown, but each decade is operated by a single plug. The scheme is to use four unit coils and one five-ohm coil, or multiples thereof, arranged so that any resistance from 1 to 9 may be plugged in. By referring to the diagram (Fig. 2) in the cover of the instrument, the exact arrangement of the coils, conductors and connections can be found.

To measure resistance with the Weston bridge, one or more cells of battery are connected to the binding posts marked B. The line or material to be measured must be connected with the binding posts marked X, and all other binding posts must be free from connections.

The manipulation of the rheostat and ratio arms is as simple as possible. The operation of "plugging in" any required rheostat resistance is obvious.

The two lines of plug-holes for ratio coils are marked "R" and "X" respectively.

When X Lies Between.		Bridge Arms Should Be	
		X	R
0 and	1 ohm	1	1,000
1 and	10 ohms	10	1,000
10 and	100 ohms	10	100
100 and	1,000 ohms	100	100
1,000 and	10,000 ohms	1,000	100
10,000 and	100,000 ohms	1,000	10
100,000 and	1,000,000 ohms	1,000	1

By placing a plug into any plug-hole on the bridge, a resistance coil terminating in a metal block will be connected with either the "X" or the "R" side of the parallelogram, according to which of two opposing plug-holes is used. Necessarily the same coil can not be used for both arms of the bridge at the same time, and two coils must be used to complete the latter. The five bridge coils have the following resistances: one unit, one ten, two of one hundred and one of one thousand ohms.

The closest results are obtained when

the bridge and rheostat are used in accordance with the accompanying table.

When the limit of the bridge is reached, higher resistances may still be determined by methods which will appear as the work is carried out.

Since all measurements are made by the zero method—that is, the pointer of the instrument is stationary when a balance is secured—it is not necessary to have large deflections, and it is safest to begin with a single cell, and increase the battery strength only after a balance has apparently been secured.

The ten divisions to the left of zero on the scale of the instrument are provided to permit its convenient use and a galvanometer when making bridge tests.

Williams & Bernhard Company.

Guy V. Williams and John H. Bernhard have opened offices in St. Louis, Mo., as commercial engineers and sales agents. Their purpose is to afford manufacturers of electrical apparatus and accessories expert representation, and they will act as general agents, marketing the entire output of their principals, or as local sales agents in the St. Louis territory for other manufacturers, under the firm name of Williams & Bernhard Company.

Mr. Williams' connection with the electrical field dates back to 1896, in the employ of J. F. Gerleman, of St. Louis, then general sales agent for the International Electric Company. Later Mr. Williams was transferred to the employ of the International company as city salesman. When the company retired from the field he entered the employ of the Columbia Incandescent Lamp Company, St. Louis, as traveling representative in Iowa, Minnesota and Wisconsin, establishing its branch office in Minneapolis, Minn. In 1899 he accepted a position with the Bryan-Marsh Company, of New York, as northwest manager, establishing its district office in Minneapolis. He conducted this office successfully until the latter part of 1902, when he was transferred to New York to become general manager of the eastern division of the company, comprising seventeen Atlantic states. In the meantime, the National Electric Lamp Company was organized, taking over the Bryan-Marsh Company among others, and during this period Mr. Williams met and solved many difficult problems. In May, 1905, the Sawyer-Man Electric Company (now the Westinghouse Lamp Company) was undergoing reorganization, and Mr. Williams accepted a position on its staff as technical adviser to the sales department, in which capacity he took an active part in the reorganization which has been so successfully accomplished. This position he now relinquishes to become associated with Mr. Bernhard. He is an associate member of the American Institute of Electrical Engineers and of the Illuminating Engineering Society.

Mr. Bernhard is a native of Holland, and graduated in mechanical and electrical engineering in 1900 and 1901. He entered the employ of the Royal Dutch Railway for one year as a workman, and for six months as an engineer in the traffic department. For two years he was technical adviser to his father's shipbuilding company, the Maatschappy van Scheepsbouw to Nieurvendam, a $400,000 company giving constant employment to over 2,000 workmen. Leaving this attachment, he toured through England, France and Spain for a year and a half, during which time he was engaged in a professional capacity by many of the important industries of these countries. Returning to Holland, he was employed as a moulder for a short time in one of the foundries there, and in 1905 he came to the United States to study American manufacturing and commercial methods. For a time he worked among various large electrical and steel companies, and then engaged as a traveling salesman for an electrical jobbing house, which position he has just left to engage in the present enterprise. Mr. Bernhard has perfected two inventions, upon which he holds European patents, and now has pending before the patent department at Washington applications for letters-patent upon two others perfected since coming to America. He is a fluent linguist, speaking Dutch, English, French and German.

Allis-Chalmers Steam Turbo-Alternators Going into Service.

The steam turbine shops, erecting and testing floors at the West Allis Works of the Allis-Chalmers Company present a busy appearance these days, caused by the increase in orders for Allis-Chalmers steam turbines since the first of the year. During the month of March more contracts for turbo-generator units were taken than for any similar period since the building of turbines was begun by the big Milwaukee company, and the orders so far received for the current month bid fair to double the March sales. As a result of this increased volume of business, every effort is being made to insure prompt delivery, erection and acceptance of the turbines at the hands of the purchaser. The facilities and organization available for this service have been developed to a high state of efficiency.

Three 1,000-kilowatt, 1,800-revolutions-per-minute turbines have been shipped to the Western Canada Coal and Cement Company, near Calgary, Canada, and will be ready for operation early next month. A 1,000-kilowatt, 1,800-revolutions-per-minute steam turbine has been erected and put in readiness for operation in the power plant of the National Cash Register Company, at Dayton, Ohio, and only waiting for the necessary condensing outfit and steam connections. Units ranging in capacity from 900 kilowatts to 5,000 kilowatts have reached various stages near to completion in the shops, for the Jamestown Woolen Mills, Jamestown, N. Y.; Savannah Lumber Company, Savannah, Ga.; Flatbush Gas Company, Brooklyn, N. Y.; Indianapolis, New Castle & Toledo Ry., New Castle, Ind.; Helderburg Cement Company, Howe's Cave, N. Y.; Kings County Electric Light Company, Gold street station, Brooklyn.

A 1,500-kilowatt, 1,800-revolutions-per-minute Allis-Chalmers turbine was erected and turned over some time ago to the New York Edison Company, Bronx station. This machine, before its acceptance, was made to operate under the worst possible turbine conditions; that is, running the turbine with saturated steam, then suddenly giving it steam with high superheat, operating under both of these conditions with twenty-eight inches vacuum, and then suddenly breaking the vacuum and operating it non-condensing. Under all these conditions the turbine operated satisfactorily and was duly accepted.

At New Rochelle, N. Y., a 1,500-kilowatt, 1,800-revolutions-per-minute turbine in the plant of the Westchester Lighting Company is operating daily, carrying the commercial load. The steam which is furnished this unit is highly superheated, the superheat often reaching 150 or 200 degrees.

At Kokomo, Ind., a 1,000-kilowatt, 1,800-revolutions-per-minute turbine has been in continuous commercial operation at the power-house of the Kokomo, Marion & Western Traction Company since February 21. The machine has been running twenty-four hours a day, with only a few hours' shutdown in sixty days.

Two of the three 1,500-kilowatt, 1,800-revolutions-per-minute machines ordered

for the Milwaukee Electric Railway and Light Company have been erected complete, and only require steam connections. The third unit has just been shipped from the shops at West Allis.

The city of Jacksonville, Fla., has two 500-kilowatt Allis-Chalmers units in regular commercial operation at 3,600 revolutions per minute. Both of these machines have made an exceedingly favorable impression on the Jacksonville authorities because of their reliability and economy of operation.

A 500-kilowatt, 3,600-revolutions-per-minute turbine in the power plant of the Western United Gas and Electric Company, at Aurora, Ill., is in regular daily operation. This machine runs so smoothly under all loads that it is said a silver dollar can be balanced on edge on any of the horizontal surfaces of turbine or generator.

In the plant of the Canton Light and Heat Company, Canton, Ohio, one of the associated companies of the American Gas and Electric Company, a 500-kilowatt, 3,600-revolutions-per-minute turbine has been carrying the commercial load for nearly two months and has been giving the best of service.

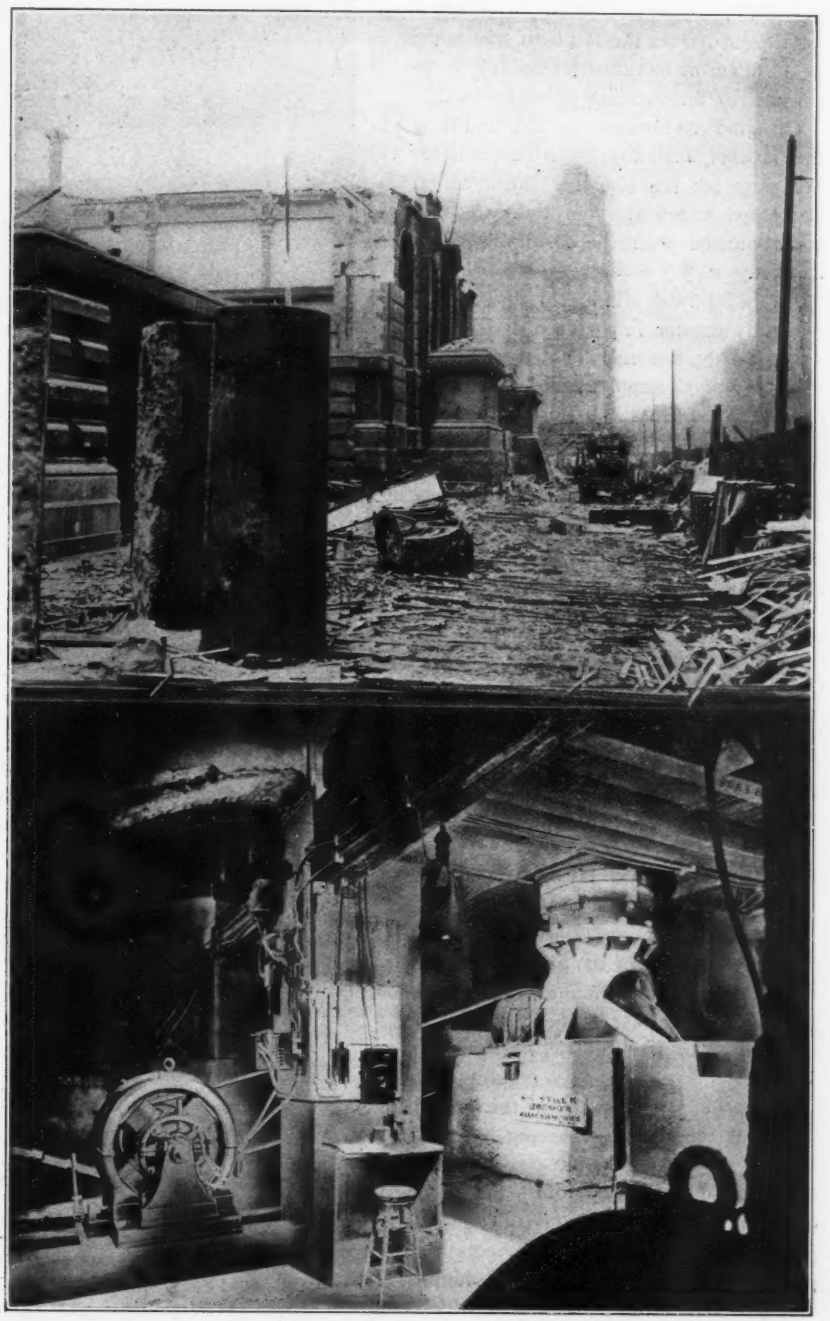
At Meriden, Ct., a 500-kilowatt, 3,600-revolutions-per-minute turbine is now successfully carrying the commercial load of the Meriden Electric Light Company. At Wilmington, Del., it has been found necessary by the Interstate Railway Company to operate a 500-kilowatt, 3,600-revolutions-per-minute turbine under conditions not contemplated in the contract; that is, it has been necessary to run the turbine non-condensing, or with very low vacuum, but in spite of the unforeseen difficulty the unit has operated faultlessly.

During the month of March alone orders were received for eight Allis-Chalmers turbo-alternator units. The Virginia Passenger and Power Company, Richmond, Va., will install one of 3,250-kilowatt capacity; the Citizens' Light, Heat and Power Company, of Johnstown, Pa., has ordered a 1,000-kilowatt unit, and the Delaware, Lackawanna & Western Railroad purchased a 2,000-kilowatt turbine unit for the Hampton Collieries, Scranton, Pa. Five other contracts cover units for service in widely different portions of the country. They are as follows: Bisbee Improvement Company, Bisbee, Ariz.; Binghampton Light, Heat and Power Company, Binghamton, N. Y.; Brush Electric Light and Power Company, Galveston, Tex.; Northampton Lighting Company, Northampton, Mass.; Savannah Lumber Company, Savannah, Ga.

A Lesson in Economy from New San Francisco.

In the rebuilding of San Francisco methods of economical leveling and construction have been sought out and practiced to a greater degree, probably, than at any other time and place in the world's history. As an instance typical of this, we may cite the work done on the Crocker Building, standing at the corner of Post and Market streets, where every avenue to waste, both of material and labor, has been most successfully closed through the exercise of a little ingenuity and forethought, aided by the best of modern crushing machinery.

This structure, which is ten stories in height, with a frontage of about 200 feet, escaped any serious damage from the earthquake, but was gutted by fire.



SCENES ABOVE GROUND AND IN THE BASEMENT OF THE OLD COOK COUNTY COURT HOUSE, CHICAGO, ILL., WHEN THE BUILDING WAS BEING TORN DOWN.

The frame of the building being intact, nothing more was necessary than a reconstruction of its interior, and the contractors at once hit upon the profitable plan of utilizing for concrete mixture all bricks, tiling, stone work and flooring which had

to be removed. Suitable apparatus was therefore installed, and, as fast as the work of tearing down made this material available, it went directly to an Allis-Chalmers "Gates" breaker fed from bins supplied by chutes from various sections of the building. After being crushed to the desired fineness, the product of the breaker passed to a mixer, and as the concrete material issued from the latter, it was taken by a system of elevators and conveyers to all parts of the building where needed.

Of chief importance in this outfit is the breaker installed by Allis-Chalmers Company for the Roebling Construction Company, who state that they are very much pleased with the results obtained from it.

An installation similar to this, but of relatively greater importance, because on a larger scale, was made by Allis-Chalmers Company at Chicago, when the old Cook County Court House was dismantled.

This temporary crushing plant, purchased by the contractors in charge of the work, J. A. McMahon & Company, of Chicago, consisted of two Gates breakers, a Gates elevator and a Gates revolving screen, all driven by electric motors.

The contractors found this plant a very profitable one, as they were able to sell the crushed rock right in the centre of Chicago; in fact, toward the close they did not have to remove any of the material from the premises, but disposed of it directly to the firm putting up the new structure.

The Shaw Non-Arcing Lightning Arrester.

The accompanying illustrations show some of the details of the Shaw non-arcing lightning arrester, manufactured and placed on the market by the Lord Electric Company, 213 West Fortieth street, New York city.

The principles underlying the present design of the Shaw non-arcing lightning arrester are based on results obtained from the various models heretofore placed on the market by the company. The company's representatives and engineers have made a careful study of a great number of plants where these arresters have been installed, and the data obtained have enabled it to keep abreast of the latest requirements of all central station and railway practice. It is the obvious purpose of an arrester to offer a path from line to earth of large capacity and relatively low static resistance. The company finds this is most easily accomplished by the use of a conducting or semi-conducting path in which a series of high dielectric elements of large faradic capacity and of high electrical resistivity is interposed.

The Shaw patents cover the basic principles of a series of partially conducting discs or rings separated by laminated insulating material, such a combination as will give the easiest possible path for a discharge of a static character and present an impenetrable barrier to the dynamic line current of normal voltage.

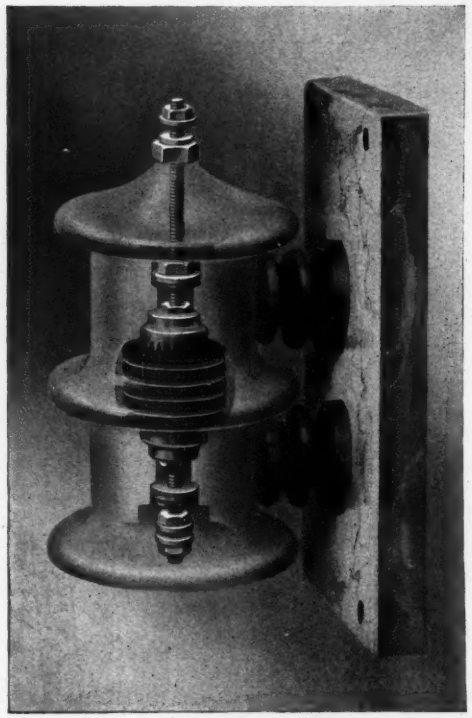


Fig. 1.—Phantom Illustration of Internal Arrangement of Shaw Non-Arcing Lightning Arrester.

Fig. 1 is a phantom illustration showing the general internal construction of this arrester.

The portions of the arrester serve as static low-resistance conductors, consisting of rings having the outward appearance of carbon, but made in accordance with a special formula which the company controls. Each non-arcing ring is formed in such a manner as to maintain equal spacing between its periphery and that of the next succeeding ring in the series. The cross-section, having the form of an ellipse, provides an internal as well as an external discharge path. Fig. 2 shows the appearance of the non-arcing rings.

Fig. 4.—Porcelain Supports.

The non-arcing rings are separated from each other by mica washers carefully calibrated according to the service for which the particular arrester is intended. These rings have large surface area, are non-absorptive in nature, and their high insulating qualities prevent the passage of a dynamic current. Fig. 3 shows the appearance of the mica separators.

Fig. 2.—Non-Arcing Rings.

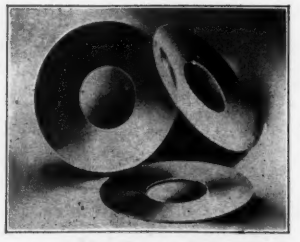


Fig. 3.—Mica Separators.

The combination of non-arcing rings and mica discs properly proportioned is mounted on special vitrified porcelain arbors. These arbors are so constructed as to give the greatest mechanical strength. They have strong dielectric properties, and are not affected by changes in temperature. The arbors are inserted into the bore of the rings and discs, leaving the peripheries exposed for the easy transmission of static discharges over large surfaces. Fig. 4 shows the appearance of the porcelain supports.

Lightning arresters for railway, electric light and power work are mounted in porcelain housings, the material used consisting of high-grade vitrified porcelain of high insulation test and finished in a dark chocolate glaze. Fig. 5 shows the form of housing used with the model A arrester.

For voltages of 1,000 and under the porcelain housings are mounted on a separate base made of seasoned, weatherproof hardwood specially treated to withstand severe atmospheric conditions. Arresters for over 1,000 volts are furnished with bases of white Italian marble.

Current Electrical News

DOMESTIC AND EXPORT.

TELEPHONES FOR MANITOBA—R. P. Roblin, premier of Manitoba, has announced that the government within sixty days will begin the construction of 1,000 miles of telephone and telegraph lines. This is a part of the public ownership policy, which will involve an expenditure of $10,000,000.

YORK HAVEN POWER COMPANY TO INCREASE DEBT—The stockholders of the York Haven Water and Power Company at a meeting held in the general office of the company at York Haven, Pa., voted to increase the company's indebtedness from $2,500,000 to $4,000,000, the same to be secured by creating a mortgage on the company's property. The increased indebtedness is for the purpose of defraying the cost of installing in the plant machinery to add 10,000 horse-power to the capacity.

MORE CAPITAL FOR SAN FRANCISCO TRACTIONS—At the annual meeting of the United Railways Investment Company, which controls the Pittsburg and San Francisco tractions, there was announced a plan to provide the San Francisco company with funds for construction and improvements. The capital stock of the United Railroads of San Francisco will be increased by an issue of $5,000,000 first preferred. The new stock is to draw six per cent and to be cumulative. A million and a half of it will be offered at once for subscription at par for cash.

ELECTRIC ROADS PLANNING MERGER—Negotiations are pending, it is said, which may result in the merger of the extensive system of electric lines in Northern Illinois, and of which the Joliet & Southern Traction Company forms a part. Should this merger be accomplished it means the ultimate connection of Joliet with St. Louis by means of the McKinley system, which is alleged to be a party to the tentative agreement. The roads interested in the consolidation are said to be the Aurora, DeKalb & Rockford railway Company, the Aurora Railway Company, the Joliet & Southern Railway Company, and the McKinley syndicate.

LICENSE FOR McKINLEY SYSTEM—The McKinley Interurban system has secured from the secretary of state a license to incorporate a company for the construction of the East St. Louis terminals of the Illinois Traction system. The company will incorporate under the name of the Tri-City Traction Company. The principal office is at Champaign, the home of Congressman W. B. McKinley, the president of the system. The capital stock is $1,000,000. The road is to be constructed from Edwardsville, Madison county, to a point on the Mississippi river near Venice, where the bridge across the river is to be built, and from Granite City to East St. Louis. The incorporators and first board of directors are: Charles Zilly, B. E. Bramble, C. A. Wright, R. R. Watson, Jr., and George M. Mattis, all of Champaign.

MILWAUKEE INDEPENDENT TELEPHONE COMPANY TO BEGIN WORK—The following officers have been elected by the Milwaukee Independent Telephone Company: H. D. Critchfield, president; E. A. Wadhams and J. S. Van Nortwick, vice-presidents; C. J. Chapin, secretary; Howard Greene, treasurer; directors: J. M. Bear, W. W. Cargill, C. J. Chapin, H. D. Critchfield, Howard Greene, J. C. Harper, B. G. Hubbell, George P. Mayer, Wilmer Sieg, Richard Valentine, J. S. Van Nortwick, E. A. Wadhams, Richard Wagner and J. B. Whitnall. A contract has been entered into with the Century Telephone Company for furnishing material and labor and completing the installation of a system of 15,000 telephones. A plant with a capacity of 75,000 telephones will be built and operations will be begun June 1, 1908.

SOUTHERN COLORADO POWER COMPANY—It is announced that a new corporation with a capital of $10,000,000, known as the Southern Colorado Power Company, will buy up all the electric lighting and power plants in southern Colorado. The company has options on all the properties of importance in the southern part of the state, including the Trinidad Light, Gas, Power and Railroad Company, which recently purchased the old Las Animas Company. The company plans to construct a network of electric railroads with Denver connections. Lighting facilities will also be afforded to numerous coal camps. Among the towns to be benefited are Clara, Sonta, Bowen, Tabasco, Berwind, Hezron, Hastings, Delagua, Majestic, Aguilar, Pryor, Rugby and Rouse.

CONTRACT AWARDED FOR ELECTRIC ROAD—The Chicago, Lake Shore & South Bend Railway Company has awarded a contract for the equipment of its power-house and for thirty-one cars to the Westinghouse Electric and Manufacturing Company. The company was organized some time ago by a number of Cleveland capitalists, among them J. B. Hanna, E. G. Tillotson and R. F. Lang, to build an electric road seventy miles in length. The system to be used will be the Westinghouse alternating-current single-phase system. The initial capacity of the power-house will be 9,000 horse-power, generated by steam turbines. The cars will each be equipped with four 100-horse-power motors. They are also to be equipped with the Westinghouse system of multiple-unit control.

HUDSON RIVER ELECTRIC POWER COMPANY—The Hudson River Electric Power Company has applied to the state gas commission for authority to issue $3,332,000 consolidated and refunding mortgage bonds, for the purpose of purchasing the flowage rights of a large reservoir on the Sacandaga river in Saratoga and Fulton counties and the construction of a dam and power-house at Conklinville. The Hudson River Electric Power Company owns the entire capital stock of the Hudson River Electric Company, the Saratoga Gas, Electric Light and Power Company, the Ballston Spa Light and Power Company, more than a majority of the stock of the Hudson River Water Power Company, and an interest in the stock of the Empire State Power Company. It has $5,777,380 stock and $4,140,000 bonds outstanding.

NEW WISCONSIN POWER COMPANY—The Northern Hydroelectric Company, capitalized at $2,000,000, has been organized at Oshkosh, Wis. The incorporators are: Frank H. Josslyn, C. H. Hartley, J. A. Powers, C. O. Josslyn and E. S. Josslyn. Frank H. Josslyn states that work on the dams and power plants at High Falls and Johnson Falls, on the Peshtigo river, will begin at once and that the outlay will be nearly $1,500,000. It is expected that power can be furnished Marinette and Menominee by next spring, the electrical energy being transmitted by cables over the twenty-three miles intervening. According to the report of the state survey the falls will generate 6,200 horse-power. The water rights were sold to the Josslyns and others last February by the Grimmer Land Company, $50,000 being paid for the properties at both falls. It is reported that most of the capital comes from Chicago.

DETROIT, MICH., CAN NOT BUILD STREET RAILWAY LINES—Municipal ownership of street railway lines in Michigan received a setback by a decision of the Supreme Court in the case of the city of Detroit. The Detroit council in 1905 had ordered the department of public works to construct lines on certain designated streets, the lines to be leased to an operating corporation granting advantageous rates and service. Five justices of the Supreme Court have decided that the city of Detroit can not build street railway tracks to be leased to an operating corporation. Four of them base their decision on the ground of constitutional prohibition against municipalities engaging in internal improvements, while Justice Ostrander held that the city could not engage in the enterprise under the statutory law. Justices Blair, Moore and Montgomery held that there was nothing in the law nor the constitution to prevent the city building the tracks.

CONTRACT FOR ELECTRICAL POWER IN CANADA—Gen. Francis V. Greene, in behalf of the Ontario Power Company, has practically completed an arrangement with the Hydroelectric

Power Commission of the Province of Ontario, whereby from 30,000 to 100,000 electrical horse-power is to be delivered to cities and towns throughout the province from Toronto as far west as Windsor. The contract will have a duration of ten years, with option of renewal for forty years, or as long as the existing contracts between the Ontario Power Company and the Queen Victoria Niagara Falls Park Commission remain in force. The price for the power up to 5,000 horse-power is to be $10.40 per horse-power per annum for twenty-four-hour power every day in the year. When the amount of power taken exceeds 25,000, the price per horse-power for the whole block is to be $10. Over 40,000 horse-power has already been applied for by the western municipalities concerned.

BUFFALO, ROCHESTER & EASTERN RAILROAD COMPANY, INCORPORATED—The Buffalo, Rochester & Eastern Railroad Company, formed to operate a standard gauge railroad by steam, electricity or gasolene from Buffalo to Rochester, N. Y., and thence to Troy, a distance of 300 miles, has filed incorporation papers with the secretary of state. The principal office of the road is to be located in Rochester and the line is to pass through the counties of Erie, Genesee, Orleans, Monroe, Wayne, Cayuga, Onondaga, Madison, Oneida, Herkimer, Montgomery, Schoharie, Schenectady, Albany and Rensselaer. The capital stock is $3,500,000 and the directors are: Ralph D. Gillett, Henry W. Ely and Archie D. Robinson, of Westfield, Mass.; Arthur W. Eaton, of Pittsfield; Franklin Weston, of Dalton; Henry W. Bowman, Fred. T. Ley, of Springfield; Joseph A. Skinner, of Holyoke; James H. Caldwell, of Troy; John J. Whipple, of Brockton, and Joseph F. Shaw, of Manchester, all being Massachusetts men except Mr. Caldwell. Mr. Gillett subscribed for $1,835,000 or over one-half of the capital stock of the company. The proposed road will connect with the Grand Trunk and New York Central at Buffalo and with the Boston & Maine at Troy. The surveys have been completed. It is estimated that it will take at least two years to build the road.

MARYLAND COMPANIES VOTE TO CONSOLIDATE—Special meetings of the stockholders of the Baltimore Electric, Maryland Telephone and Telegraph Company and the Baltimore Electric Power Company were held on May 4 for the purpose of voting on a proposition to consolidate under the name of the Baltimore Electric Company when the proposition was accepted. The two companies are controlled by the same interests; in fact, the electric company operates under a franchise of the telephone company, leasing the right from the latter. The telephone company has a capital stock of $1,000,000, and the electric company $2,500,000. It is understood that the capital stock of the new company will be $2,500,000, or the same as the electric power company now has. It is probable that it will also have an authorized bond issue of $7,500,000, equal to that of the telephone company. The directors elected by the new company are practically the same as those of the telephone company. The bonds of the telephone and electric companies were deposited several weeks ago with the Baltimore Trust and Guarantee Company, of Baltimore, and the Northern Trust Company, of Philadelphia, under the plan for the consolidation, and it is understood that a new deed of trust will be drawn. The lighting and power department will now be operated as the Baltimore Electric Company, and the telephone department as the Maryland Telephone Company. The organization is practically unchanged.

PERSONAL MENTION.

MR. W. J. PHELPS, the well-known vice-president and manager of the Phelps Company, Detroit, Mich., was a Chicago visitor last week.

MR. HORTON S. ALLEN has been appointed district manager for the New England Telephone and Telegraph Company, with headquarters at Newton, Mass.

MR. JOHN W. SEAVER, vice-president of the Wellman-Seaver-Morgan Company, has resigned and will engage in consulting engineering in Cleveland, where he has opened offices in the Caxton Building.

MR. F. P. FISH, who recently resigned from the presidency of the American Telephone and Telegraph Company, has entered the new law firm of Fish, Richardson, Herrick & Neave, with offices at 84 State street, Boston, Mass., and 5 Nassau street, New York city.

MR. GEORGE BULLOCK has been elected president of the Lancaster County Railway and Light Company, succeeding W. W. Griest. The company operates over 200 miles of trolley roads and several electric light and gas plants.

MR. A. J. GODDARD, president and manager of the Freeport (Ill.) Railway, Light and Power Company, was a visitor to Chicago last week, purchasing machinery and supplies in connection with improvements and enlargements the company is undertaking.

MR. B. F. EYER, professor of electrical engineering, Kansas State Agricultural College, Manhattan, Kan., has written an interesting article in *The Industrialist*, No. 26, published by the Kansas State Agricultural College, describing the electrical engineering course offered by the college.

MR. LEON GASTER, of London, England, who represented the Faraday Society at the recent dedication of the Engineering Societies Building, and who has been investigating the lighting situation in a number of American cities, sailed on Wednesday on the steamer Majestic for Liverpool.

DR. ELIHU THOMSON delivered an interesting address on the "West India Islands and the Panama Canal" before the Lynn (Mass.) Twentieth Century Club, at the rooms of the Lynn Historical Society, on Wednesday evening, May 1. Dr. Thomson has recently returned from an extended trip through the West Indies and the Isthmus of Panama.

MR. J. H. HALLBERG, consulting engineer, New York city, announces that part of his time is now devoted to the design and manufacture of flaming arc lamps and other electrical specialties. This addition to his regular engineering business has necessitated the cooperation of a factory. In view of this fact he has moved from 45 Broadway to 30 Greenwich avenue, and is occupying offices with the Beck Flaming Lamp Company, acting as engineer and general manager. In addition to this he retains his old clients and does a general consulting engineering business.

MR. IRA McCORMACK has been appointed assistant to the general manager of the New York Central & Hudson River Railroad. He has just been succeeded by A. R. Whaley as manager of the Grand Central station and general superintendent of the road's electric division. Mr. McCormack was for twenty years connected with steam railroad work before he became associated with the Brooklyn Rapid Transit Company in 1895 as superintendent. He later became vice-president and director of the Syracuse (N. Y.) Rapid Transit Company. He then was appointed general manager of the Cleveland Electric Railway. In 1902 he became assistant manager of the Grand Central station, being advanced to manager in 1903. In 1905 he was made general superintendent of the electric division.

OBITUARY NOTES.

MR. NATHAN GUILFORD, a former vice-president of the New York Central & Hudson River Railroad, died at Yonkers, N. Y., on Saturday, May 11. Mr. Guilford was sixty-six years of age, and had spent forty-four years of his life in the service of various railroads. He was born in Cincinnati, Ohio, in 1841. He served two years in the Union Army with the Second Ohio Volunteer Infantry, from 1861 to 1863. In 1879 he became vice-president of the New York and Manhattan elevated railways. In 1887 he was made general traffic manager of the New York Central & Hudson River Railroad. In 1905 he became a vice-president of the road.

MR. CHARLES HAYNES HASWELL, one of the best known civil and marine engineers of the country, died on Sunday, May 12, at his home, 324 West Seventy-eighth street, New York city, as the result of a fall. Mr. Haswell was born in New York on May 22, 1809. He was graduated from the Collegiate Institute of Joseph Nelson. His first labor was in the engine works of James P. Allaire. He designed the engines and boilers for the United States steam frigate Fulton, and was first chief engineer and engineer-in-chief of the United States Navy from 1836 to 1851. He was engineer of the Health Department, the Department of Charities and Correction, and trustee of the New York and Brooklyn bridge. Since 1898 he was consulting engineer to the Board of Public Improvements of New York city. He was engineer in charge of the extension and improvement of Riker's Island, in Long Island Sound, and assistant engineer of the Board of Estimate and Apportionment. From 1855 to 1858 he was a member of the New York board of councilmen, serving as president of the board in the latter year. He was an honorary member of the American, Boston and Philadelphia societies of civil engineers, a life member of the Institute of Civil Engineers and Naval Architects, and was the author of a number of standard works on mechanics and applied science.

ELECTRIC LIGHTING.

STANTON, NEB.—It has been voted to install a municipal lighting plant.

WICHITA, KAN.—The council has passed an ordinance granting a thirty-year franchise to J. O. Davidson to operate an electric lighting plant in Wichita.

NORWICH, N. Y.—The Oriskany Hydroelectric Company has obtained permission from the Sherburne town board to erect a line of poles through that town.

LEBANON, PA.—The borough council of Jonestown is considering a proposition to light the streets of the town by electricity. It is planned to harness the Swatara creek.

PHILADELPHIA, PA.—J. H. Young has been commissioned to plan a municipal electric light and waterworks system for Haddonfield, N. J. The cost will be about $125,000.

BROOKVILLE, IND.—The contract for lighting the city for the next twenty years has been awarded to Cincinnati and Aurora capitalists, at the contract price of $54 a light, moonlight schedule.

URBANA, OHIO—The city has entered into a contract with the Urbana Light Company for ninety-three or more arc lights at $75 a lamp a year for the first 100, and $75 a lamp for all above this number.

ELMIRA, N. Y.—T. M. R. Meikleham, W. B. Dinsmore and R. H. Tingley, of New York, have purchased a controlling interest in the Waverly Electric Light and Power Company from G. Tracy Rogers, of Binghamton.

CLIFTON FORGE, VA.—The city council has accepted the bid of the Clifton Forge Light and Water Company to furnish electric lights to the city for the next fifteen years. The company bid $800 for the franchise.

ROCKLAND, MASS.—The Electric Light and Power Company, of Abington and Rockland, has petitioned the state board of gas and electric light commissioners for permission to issue new stock to the amount of $60,000.

HAMILTON, OHIO—The board of public service has decided to combine Hamilton's new waterworks and municipal electric light plant under one roof. A single power plant will serve both. The city is spending about $300,000 in enlarging its public plants.

TRAVERSE CITY, MICH.—It is announced that J. J. Tweedle and others will form a company to furnish electric power for Leetion on the dam at Leland. Between 600 and 700 horse-power can be produced. The company has customers at Sutton's Bay, Leland, Provemont, Omena and Northport.

EAST GRAND FORKS, MINN.—By practically a unanimous vote the citizens of East Grand Forks decided in favor of entering into a contract with the Grand Forks Gas and Electric Company to supply the city with electricity, and not to rebuild the municipal lighting plant, which was burned recently.

ALBION, N. Y.—The town board of Albion has granted to A. L. Swett, of Medina, the right to construct and operate electric heat and power lines in the town outside the village of Albion. It is understood that Mr. Swett intends bringing his lines to the De Graff quarry, about three miles from Albion, this season.

CANTON, OHIO—Announcement is made that the Merchants' Heat, Light and Power Company has been bought by the Canton Light, Heat and Power Company. The Merchants' Heat, Light and Power Company was organized to give cheap light to Canton and to operate a steam heating plant. The heating apparatus has been installed in many places.

PAXTON, ILL.—J. W. M. Burton, of North Fond du Lac, Wis., has purchased and will operate the Paxton electric plant. He will install new machinery and will operate the steam-heating plant as well as furnish the power to pump water for the city. The plant originally cost about $50,000 and probably $50,000 more has been added to it in improvements.

LAFAYETTE, COL.—The last of the twenty-eight boilers for the Northern Colorado Power Company's electric plant at Lafayette has been put in place and the two $50,000 turbine engines are also about set up. The wire is strung between Lafayette and Boulder and Lafayette and Longmont, and it is expected that the current will be turned on about the middle of May.

OREGON CITY, ORE.—Thomas Withycombe has appropriated 2,000 cubic feet of water per second from the Clackamas river in section 18, township 2 south, range 3 east, and has filed a declaration to use this water for manufacturing and power purposes. Withycombe is interested in a proposition to establish a cooperative colony east of Oregon City.

ROCHESTER, N. Y.—The work of erecting the second line of steel towers between Rochester and Syracuse by the Niagara, Lockport & Ontario Power Company has been resumed, with gangs working east and west. The purpose of the line is to increase the amount of electricity delivered at Syracuse, and to provide safeguards against delays due to interruptions in the delivery. Most of the interruptions, it is said, have been due to lightning.

NEWCASTLE, IND.—One of the largest power-houses in Indiana is to be erected in Newcastle by Ambrose Petry, of Detroit, who is associated with other wealthy capitalists of Detroit and recently purchased the holdings of the Newcastle Light, Heat and Power Company. A deal has been closed for ground and a plant will be built of sufficient capacity to supply Newcastle and surrounding territory with electricity for light purposes and also for power. The company will expend close to $1,000,000.

WAUSAU, WIS.—Articles of incorporation of the Bean's Eddy Power Company have been recorded in the office of the register of deeds. The incorporators are P. C. Hart, Charles E. Guenther and H. G. Flieth, and the capital stock is $36,000. The incorporators have for some time been the owners of the land adjoining the water power at Bean's Eddy, and incorporate now for purposes of convenience in the matter of securing a charter to construct a dam and develop the power. Bean's Eddy is situated between Knowlton and Mosinee on the Wisconsin river and is about half way between Wausau and Stevens Point. It has long been considered as one of the best small water powers on the Wisconsin river. There is a fourteen-foot head capable of developing 3,600 horsepower at low water.

COLUMBUS, OHIO—At the annual meeting of the stockholders of the People's Light, Heat and Power Company, of Springfield, held at the offices in Springfield. John Siebert, president of the Ohio National Bank, retired as a director of the company, and Ben H. Harmon, manager of the Neil House and secretary of the Iroquois Hotel Company, was elected to succeed him. Other directors elected were R. R. Mills, John L. Zimmerman, F. M. Hagens, W. W. Kiefer and Charles F. Kay, of Springfield; J. D. Price, John W. Dages, L. M. Ferguson and John K. Henry, of Columbus. The old officers, John L. Zimmerman, president; L. M. Ferguson, vice-president, John K. Henry, secretary; W. W. Kiefer, treasurer; Charles S. Kay, general manager, were reelected. The reports of the financial officers of the company showed an increase in gross earnings for the last year.

DENVER, COL.—Five directors, including United States Senator Francis E. Warren, J. J. Henry, Tyson Dines, O. L. Dines and Albert S. Brooks, resigned from the board of directors of the Northern Colorado Power Company at the annual meeting, and ten new directors, in addition to three former members of the board, were elected. N. A. Carle, vice-president and general manager of the Northern Colorado Power Company, announces that the power plant under course of construction at Lafayette will be in shape to supply power to Boulder by June 1, and that by August 1 the company will have expended $1,000,000 in Colorado and will be supplying power to Fort Collins and all intermediate towns. The number of members of the board of directors was increased from eight to thirteen, and five New York men were elected. The new board is composed of the following persons: Harry Bronner and Hans Winterfeldt, of Hallgarten & Company, New York bankers; John F. Wallace and James N. Wallace, of the Central Trust Company, New York; George C. Smith, vice-president of the Electric Properties Company, New York; W. J. Barker, Denver; N. A. Carle, Denver; W. F. Crossley, Fort Collins; E. E. Whitted, Denver; Thomas Keely, Denver; W. H. Alliston, Boulder; W. Mayher, Greeley, and J. P. Miller, Lafayette. The members of the old board who were reelected are W. J. Barker, N. A. Carle and Thomas Keely.

ELECTRIC RAILWAYS.

LEBANON, OHIO—The Dayton, Lebanon & Cincinnati Railroad has been sold for $200,000 to the bondholders of the road.

LONG BRANCH, N. J.—A franchise has been granted the New Jersey Traction Company by the Monmouth county commissioners.

AMES, IOWA—The citizens of Ames at a special election granted a franchise to the Fort Dodge, Des Moines & Southern interurban line for twenty-five years.

SPOKANE, WASH.—Electric train service on the eastern division of the Palouse line of the Inland Empire system has been inaugurated to Oakesdale, thirteen miles south from Spring Valley junction.

NEWBERRY, S. C.—The city council has granted a franchise for a street railway in the city of Newberry to H. L. Parr and others of Newberry. The power will be obtained from Parr Shoals, on Broad river, which will be developed at an early date.

DES MOINES, IOWA—It is announced that the Polk interests have purchased of the Newton & Northwestern Railway the line of railway extending from Colfax to Newton and that it will be electrified at once and operated as an extension of the Des Moines-Colfax interurban system.

ELKINS, W. VA.—The Elkins city council has granted the Elkins Railway Company, backed principally by Pittsburg capital, a fifty-year franchise, under the provisions that the company is to have cars running in eighteen months. This line will form part of the line from Elkins to Grafton.

CHATTANOOGA, TENN.—The Chattanooga Railway Company has decided to build an electric line up Lookout Mountain and will begin work on it soon. The new line will follow the route of the old broad-gauge steam road most of the way, and but little grading or blasting will have to be done.

EVERETT, WASH.—A franchise has been granted by the board of county commissioners to the Puget Sound, Skykomish & Eastern Railway Company to build an electric railway from Index to a point about one and one-half miles from that place. The franchise also grants the right to construct telephone and electric light systems.

SOUTH FRAMINGHAM, MASS.—The Boston & Worcester Street Railway Company will begin at once the widening of Worcester street, at South Framingham, incident to the double tracking of the system from Central Square, Framingham, to the Southboro line. The work will take a year or more to complete, at an estimated cost of $300,000.

NEW HAVEN, CT.—Plans have been announced by an officer of the Consolidated Railway Company providing for a $200,000 improvement to the power-house on Grand avenue, which include the enlargement of the building and the installation of new machinery and boilers. An addition to the present building will be contracted for in a short time.

OKLAHOMA CITY, OKLA.—General Manager John W. Shartel, of the local street railway system, has announced that the appropriations made by the board of directors for improvements and extensions and equipments of the local street railway for the current year amount to $666,500. Several miles of extensions will be built during the next few months.

BRIDGEPORT, ALA.—T. W. Pratt, of Huntsville, has been granted a franchise by the city council to build and operate an electric railroad, and an electric light and power plant. The company expects to connect Bridgeport with Copenhagen and South Bridgeport at once, and later extend the system to Jasper, Huntsville, Scottsboro and Stevenson.

LINCOLN, NEB.—The state railroad commission has issued an order to street railways to abrogate contracts made with the Government for the carrying of mail carriers at a reduced rate. Policemen and firemen are also included in the order, which prohibits the carrying of any person at less than the regular fare or for any rate not open to the general public.

HENDERSON, KY.—The Henderson Traction Company has filed a deed of trust to the Ohio Valley Banking and Trust Company for $150,000 to be floated on the property, $95,000 to be used to pay for the railway plant, $10,000 for fees and costs of suits of sale and $45,000 for making extensions. The bonds are gold-bearing and are to run for twenty years, with five per cent interest.

BROOKLYN, N. Y.—Work has been begun to connect the elevated railroad in Broadway, Williamsburg, with the Williamsburg bridge. The terms of the contract call for the completion of the work by September 30, and a month later the Brooklyn Rapid Transit Company is supposed to have its cars running across the bridge. The work on the Brooklyn side alone will cost $100,000.

MACON, GA.—At a meeting of the stockholders of the Macon, Americus & Albany Electric Railway Company a permanent organization was effected by the election of the following officers: Joseph S. Davis, president; W. J. Kincaid, first vice-president; John T. Moore, second vice-president; N. J. Cruger, secretary; W. J. Massee, treasurer; Stuart C. Davis, assistant secretary and treasurer, and M. Felton Hatcher, general counsel.

WATERTOWN, N. Y.—The Black River Traction Company has begun the survey of the proposed trolley line to connect Watertown and Depauville. It is proposed that the road shall connect with the Black River Traction Company's present line and the New York Central at the No. 4 mill on the Brownville road and be surveyed so as to serve Gunn's Corners, Perch River, Depauville and the territory lying between those points.

CHICAGO, ILL.—The organization of the Calumet Electric Railway Company has been completed. Officers and directors are as follows: president, I. M. Cobe; vice-president, J. W. McKinnon; secretary and treasurer, Frank H. Murray; directors, L. E. Meyers, B. F. Harris, G. E. Shaw, J. W. McKinnon and Ira M. Cobe. Officials of the company report that substantial growth in business has occurred since the property was taken over by the syndicate last summer.

NEW YORK, N. Y.—Construction of a new trolley line along the south shore of Long Island has been commenced. The Cross Island Traction Company, composed of New York banking interests headed by Joseph G. Robin, has absorbed the South Shore Traction Company, and it is understood that $1,500,000 is ready for the completion of the road. James T. Wood, president of the Cross Island company, will head the new combination, and Spencer & Company have been retained as engineers.

FALL RIVER, MASS.—A new company to build and operate a street-car line to Horseneck Beach and Westport Point has been formed under the name of the Shore Line Street Railway Company, with a capital stock of $75,000. The board of directors comprises seven, as follows: Charles F. Parker, of Woonsocket, R. I.; A. C. Ralph, of Taunton; Andrew H. Sowle, of Westport; B. W. Gleason, of Boston; J. M. Shorrocks, of Westport; Jeffers F. Richardson, of Albany, N. Y.; N. L. Sheldon, of Boston.

NEWBURGH, N. Y.—The Orange County Traction Company is contemplating the extension of its line to Montgomery, and the Wallkill Transit Company, connecting Middletown and Goshen, is said to be considering the feasibility of extending its line from Goshen to Montgomery. A power plant is now being built on the Wallkill river falls at Walden, and it is believed this plant is to furnish the power for the extended lines. Ex-Governor Odell is said to be at the head of the proposed enterprise.

HYATTSVILLE, MD.—The organization of the Washington Spa Spring & Gretta Electric Railroad Company has been perfected. The following officers were elected: B. D. Stephen, president; S. S. Yoder, vice-president; Fillmore Beall, secretary; R. Y. Ryon, treasurer, and James C. Rogers, general counsel. These gentlemen, with William W. Poultney, William P. Magruder, J. Enos Ray, Jr., and J. Harris Rogers, were chosen directors. By act of the last Congress, approved February 18, a franchise was granted for this road to enter the city of Washington by way of the Bladensburg road. The projected route of the road extends from Hyattsville to the district line, through Bladensburg, Gretta and Charlton Heights on the county road leading from the Edmondston road to Branchville. The ultimate terminals are Baltimore and Gettysburg, *via* Frederick, taking in the rich farming communities of Howard and Frederick, these sections being at present without transportation facilities.

NEW PUBLICATIONS.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION—The proceedings of the American Street and Interurban Railway Association for 1906 has been published, containing a complete report of the twenty-fifth annual convention, held at the state fair grounds, Columbus, Ohio, October 17, 18 and 19, 1906.

THE UNIVERSITY OF MINNESOTA BULLETIN—The College of Engineering and Mechanic Arts, University of Minnesota, Minneapolis, Minn., has published its announcement for 1907-1908. This bulletin indicates the university calendar, the board of regents, executive officers, the faculty, and courses of study. There is also a list of the students.

EDUCATIONAL NOTES.

THE MICHIGAN COLLEGE OF MINES—Dr. Ira Remsen, president of Johns Hopkins University, Baltimore, Md., delivered the class-day address at the mining college gymnasium of the Michigan College of Mines, Houghton, Mich., on Friday evening, May 3. The graduating class this year is the largest in the history of the institution, over fifty men being graduated.

RAILWAY LECTURES AT CORNELL—A series of railway lectures is being delivered at Cornell University, Ithaca, N. Y., which the mechanical and electrical engineering students are attending. The lecturers are C. O. Mailloux and W. N. Smith, of Westinghouse, Church, Kerr & Company. Mr. Mailloux's lectures dealt with velocity-time curves and mechanical integration as applied to their manipulation. A series of six lectures now being delivered by Mr. Smith cover the following topics: "Preliminary Examination to Determine the Status of the Railway Project;" "Topography, Train Tonnage and Time Tables;" "Speed-Time Curves and Other Methods for Power Determination;" "Working Conductors—Trolley, Third-Rail and Transmission Lines;" "Substation and Power-House Location and Equipment;" "Steam *versus* Electricity in Operation."

ENGINEERING SOCIETY NOTE.

THE FORT WAYNE ELECTROTECHNIC CLUB—Professor P. B. Woodworth, of Lewis Institute, Chicago, Ill., addressed the Fort Wayne Electrotechnic Club, Fort Wayne, Ind., on Tuesday evening, May 7. The subject of the lecture was, "The Engineer's Curve."

ELECTRICAL SECURITIES.

There was considerable liquidation in the stock market last week, the net result being as many declines as there were advances, with the declines overshadowing so far as the aggregate is involved. Looking over the whole situation there were many discouraging features, notably the crop estimates made by the Government. Banking interests, as a rule, look for continued market dullness, with probably sagging prices. Later on, however, it is certain that prices will advance, as the sluggishness will mean the accumulation of resources which will ultimately be brought into the situation. It is probably one of the best indications that we have witnessed for some time, that business generally is disposed to regard a season of rest dispassionately and embrace the opportunity to recuperate from the effect of the strenuous life which has been so popular for the last few years.

ELECTRICAL SECURITIES FOR THE WEEK ENDING MAY 11.

New York:	*Closing.*
Allis-Chalmers common	11
Allis-Chalmers preferred	31⅞
Brooklyn Rapid Transit	58¾
Consolidated Gas	131½
General Electric	145½
Interborough-Metropolitan common	22
Interborough-Metropolitan preferred	56⅜
Kings County Electric	126
Mackay Companies (Postal Telegraph and Cables) common (ex-dividend)	70½
Mackay Companies (Postal Telegraph and Cables) preferred (ex-dividend)	69
Manhattan Elevated	138
Metropolitan Street Railway	94
New York & New Jersey Telephone	113¾
Western Union	82¾
Westinghouse Manufacturing Company (ex-dividend)	144¼

The retiring directors of the Interborough Rapid Transit Company have been reelected.

The income account of the Interborough Rapid Transit Company for the three months ended March 31 is as follows: gross earnings, $6,031,899; operating expenses, $2,496,657; leaving net earnings of $3,535,242. Other income brings the total to $3,768,954. Deducting for interest, rent and taxes the sum of $1,464,678, leaves a net income of $2,304,276. Of this amount there was paid 7 per cent on Manhattan Railway stock, or $1,050,000, leaving a surplus of $1,254,276. The operating expenses were 41.39 per cent of the earnings. The passengers carried were 121,067,698.

Theodore P. Shonts has been elected a director of the New York City Interborough Railway Company in the place of Arthur Turnbull. The other directors have been reelected.

The shipments of the Westinghouse Electric and Manufacturing Company for the first month (April) of this fiscal year, exclusive of subsidiary companies, exceeded those of April, 1906, by $1,083,147, this increase being a reflection largely of increased manufacturing facilities and partly of better prices.

Boston:	*Closing.*
American Telephone and Telegraph	123
Edison Electric Illuminating	205½
Massachusetts Electric	57
New England Telephone	118
Western Telephone and Telegraph preferred	70

Francis Henshaw & Company sold at public auction on May 8 10,902 shares of the new capital stock of the Edison Electric Illuminating Company of Boston, pursuant to an order of the board of gas and electric light commissioners. The block of stock was the largest ever sold at auction in Boston at one time, and involved more than $2,000,000. The opening sale was 105 shares at 204¾, and there were later sales at 203⅜ and 204¼.

At the annual meeting of the New England Telephone and Telegraph Company, William J. Denver and Matt E. Jones were elected directors in place of Alexander Cochrane and David B. Parker, both resigned. Other directors, including Frederick P. Fish, were reelected. The representation at the annual meeting—264,000 shares—was the best ever recorded and compares with 231,000 shares last year. President Sherwin in his annual report estimates that during 1907 $5,500,000 will be needed for maintenance and extensions. Of this amount $3,000,000 will be for maintenance and this change comes from revenue from operations. No decision has been yet arrived at as to whether new capital will be raised this year. The outstanding capital of the New England company is $31,000,000 while the authorized capital amounts to $50,000,000 and the directors, without further authorization from stockholders, can issue as they deem best nearly $20,000,000 more stock.

Philadelphia:	*Closing.*
Electric Company of America	10
Electric Storage Battery common	50½
Electric Storage Battery preferred	50½
Philadelphia Electric	8½
Philadelphia Rapid Transit	21¼
United Gas Improvement (ex-dividend)	91½

While the Philadelphia Rapid Transit Company will receive upwards of $2,900,000 from the recent assessment of $5 per share on its capital stock, it is understood that all this money will be used on the Market street subway work. It is stated that the company will undertake no new work nor extension of lines this year. Every energy is to be devoted to the completion of the subway before April, 1908. This work is now well under way.

Chicago:	*Closing.*
Chicago Telephone	130
Chicago Edison Light	143
Metropolitan Elevated preferred	65
National Carbon common	70
National Carbon preferred	114⅞
Union Traction common	—
Union Traction preferred	—

The Chicago Telephone Company reports a net increase of 3,228 in April in the number of its telephones in service. This raises the total number of its instruments in service to 182,911, of which 131,507 are in the city and 51,404 are in the country and country towns.

TELEPHONE AND TELEGRAPH.

YREKA, CAL.—The telephone company has commenced operations in constructing a telephone line from Yreka to Oak Bar, Gottville, Quigley's Ranch and Horse Creek, from where it will be extended to the Blue Ledge Copper mines.

YOUNGSTOWN, OHIO—Fully $250,000 will be expended upon improvements here this summer by the Citizens' Telephone Company, according to the statement of Superintendent C. P. Mebane. Nearly $50,000 of this will be devoted to a new and improved switchboard of the most modern type.

WEST LEYDEN, N. Y.—The farmers between this place and Ava have organized a company to build a private telephone line. The organization will be known as the North Ava Telephone Company. Frank P. Grubel was elected president and Frank E. Wolfe secretary and treasurer of the company.

NEW CASTLE, PA.—The entire capital stock of the New Wilmington Telephone Company has just been purchased by Robert J. Totten of New Wilmington for $4,000. Totten is secretary of the Plaingrove Independent Telephone Company and is said to hold a controlling interest in it, so the two companies may be united.

MINNEAPOLIS, MINN.—Telephone connection between Minneapolis and Winnipeg is an important part of the plan of government ownership that is now being developed in western Canada in the construction of an independent telephone system. J. H. Howden, minister of railways, telegraph and telephone service for Manitoba, is one of the prime movers in the project, and was in the city recently looking over the situation.

PLYMOUTH, N. H.—A deal has been completed by which the franchises of four telephone companies pass into control of the White Mountains Telephone and Telegraph Company. This company, chartered at the last session of the legislature, has secured the franchises of the Plymouth and Compton exchange of the Pike Telephone Company and the Woodsville and Woodstock (Vt.) exchanges. Allen Hollis, of Concord, is president of the company.

COLUMBUS, OHIO—At a special meeting of the stockholders of the Columbus Citizens' Telephone Company, the capital stock of the company was increased to $1,760,000 by the issue of $500,000 of six per cent cumulative preferred stock. D. C. Beggs and J. H. Mohler, of Columbus, were added to the board. Reports showed the company now has 12,500 telephones, an increase of fifty per cent in fourteen months. The entire issue of stock has been underwritten.

SPOKANE, WASH.—F. C. MacGougan, manager of the Pacific Telephone and Telegraph Company, announces that from $500,000 to $750,000 will be expended in Spokane in the betterment of the service. The company has under consideration the erection of a new exchange building, while another plan is to erect one or two branch exchanges to be operated in connection with the present plant. Every telephone in Spokane will be exchanged, a new instrument of the latest model being installed in place of those now in use. When the improvements are completed, ninety-five per cent of the Bell telephone wires in Spokane will be in cables, either underground or overhead. Twenty-two miles of underground cable and thirty miles of aerial cable are now in use.

DATES AHEAD.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

Virginia State Independent Telephone Association. Annual meeting, Norfolk, Va., May 21.

American Society of Mechanical Engineers. Annual meeting, Indianapolis, Ind., May 28-31.

International Independent Telephone Association. Chicago, Ill., June 4-6.

National Electric Light Association. Annual meeting, Washington, D. C., June 4, 5, 6 and 7.

American Railway Master Mechanics' Association. Annual meeting, Atlantic City, N. J., June 12-14.

Pacific Coast Electric Transmission Association. Los Angeles, Cal., June 18-20.

Association of Railway Telegraph Superintendents. Annual meeting, Norfolk, Va., June 19.

American Society for Testing Materials. Annual meeting, Atlantic City, N. J., June 20-22.

American Institute of Electrical Engineers. Annual meeting, Niagara Falls, N. Y., June 25-28.

NEW MANUFACTURING COMPANIES.

WATERTOWN, N. Y.—Articles of incorporation have been filed by the Green Electrical Supply Company. Its capital stock is to be $20,000. The directors for the first year are: Warren J. Green, Ernest C. Madden and George B. MacComber.

ALBANY, N. Y.—The Cahill Telharmonic Company, of New York city, has been incorporated with the secretary of state to distribute music electrically and to own lines for that purpose, with a capital of $500,000. The directors are O. C. Reynolds, J. C. Rowe, John Thomson, W. F. White, Robert Tileston, New York; A. B. Triggs, Brooklyn.

TRENTON, N. J.—The Electrical Mechanics Development Company has filed articles of incorporation with a capital of $100,000. It is stated that the company will manufacture an electrical device for transforming alternating current into direct current. The officers are O. H. Brown, president; Dr. J. H. Bryan, vice-president; Frank Durand, treasurer, and W. W. Rowan, secretary.

BIRMINGHAM, ALA.—A company styled the Burney Electric Company has filed articles of incorporation. The incorporators are C. W. Burney, Charles C. Lamar and J. G. Pulliam. The capital stock of the corporation is $3,500 and it starts business with all the capital subscribed. The object of the new company is to manufacture and sell various electrical devices and to do a general electrical business.

INDUSTRIAL ITEMS.

THE LINDSTROM, SMITH COMPANY, Chicago, Ill., has moved into larger quarters at 253-261 La Salle street.

THE CENTURY ELECTRIC COMPANY, St. Louis, Mo., announces the new location of its New York city office at 232 Fulton street.

W. R. OSTRANDER & COMPANY, 22 Dey street, New York city, has ready for distribution its 1907 catalogue for electric fans and accessories.

THE NEW YORK ELECTRIC CONTROLLER COMPANY, New York city, announces its removal to larger quarters at 35 and 37 Rose street.

THE ARTHUR JONES COMPANY, Chicago, Ill., is now handling the specialities manufactured by the Marshall Electric Manufacturing Company, Boston, Mass.

THE ELECTRIC SERVICE SUPPLIES COMPANY, Philadelphia, Pa., announces the removal of its New York office from 85 Liberty street to the United States Express Building, No. 2 Rector street.

THE H. O. S. ENGINEERING COMPANY, Newark, N. J., has ready for distribution a series of cards calling attention to its "H. O. S." switches, "Falcon" receptacles and extension plugs, and "Columbia" direct-current arc lamps.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Ct., is calling attention to some of its specialties in a small bulletin which will appear the first of each month. This bulletin is entitled "Trumbull Cheer."

THE H. C. K. COMPANY, New York city, announces the removal of its offices from 45 Broadway to 30 Greenwich avenue, where larger quarters will be secured. The offices of the company will also be consolidated with the factory at this new location.

THE DUNCAN ELECTRIC MANUFACTURING COMPANY, Lafayette, Ind., in bulletin No. 5, describes the Duncan standard high-torque, direct-current wattmeter, the type "A-D" direct-current meter, the type "A-C" alternating-current wattmeter and the Duncan monetary meter.

THE BENJAMIN ELECTRIC MANUFACTURING COMPANY, 42 West Jackson Boulevard, Chicago, Ill., has rearranged its offices and acquired additional floor space for the manufacturing end of its business. The company's offices are elaborately fitted up and excellently placed.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., has published a very interesting booklet entitled, "Motor Starters *versus* Fire Starters." This pamphlet discusses the status of motor starters with regard to the present Underwriters' rules. Some interesting information is also given concerning the Navy Department specifications.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., is distributing a useful and attractive calendar which is illustrated by a picture in colors of the City Investing Building, now in course

of construction in New York city. The structural-steel work above the street level is being protected from corrosion with Dixon's silica graphite paint.

THE KEYSTONE ELECTRICAL INSTRUMENT COMPANY, Philadelphia, Pa., has ready for distribution its catalogue No. 14, descriptive of electrical measuring instruments. Although the company apologizes for the appearance of this catalogue, it in no way reflects discredit upon it. The information is very complete, and will be found of great value to any one interested in electrical measuring instruments.

THE WESTERN ELECTRIC COMPANY, Hawthorne, Ill., has published a handsome bulletin descriptive of Western Electric fan motors. This includes the "Hawthorne" universal fan motor for direct-current circuits, the "Zero" desk fan motors, telephone booth motors, ceiling fan motors, and alternating-current desk and bracket fan and alternating-current ceiling fans. The catalogue also includes illustrations and descriptions of ventilating outfits, sewing-machine motors and appliances for fan motors.

THE ROBBINS & MYERS COMPANY, Springfield, Ohio, has published a very attractive leaflet describing and illustrating the "Standard" direct-current bracket, desk, exhaust and ceiling fans. The company has recently moved its New York office and salesroom from 66 Cortlandt street to 145 Chambers street, where it will occupy a five-story building. This new location provides facilities for carrying a larger stock and making more prompt deliveries. The New York office will henceforth also look after all the New England trade and make deliveries from New York stock.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, Mo., has ready for distribution bulletin No. 76. This describes single-phase, variable-speed ventilating fan outfits. The principle employed for speed variation is that of the auto-transformer connected to a regulating head, by means of which the actual voltage applied to the motor is controlled. The company believes that the single-phase, variable-speed ventilating fan outfit with the auto-transformer speed control will prove an exceedingly valuable aid to central-station managers who are seeking new power business.

Record of Electrical Patents.

Week of May 7.

852,414. CIRCUIT-MAKING AND BREAKING DEVICE. Samuel Bouton, Lynn, Mass., assignor of one-half to Albert B. Black, Concord, Mass. A rotating contact maker.

852,424. SECONDARY BATTERY. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to Edison Storage Battery Company, Orange, N. J. A rectangular battery receptacle, one or more of the walls of which are corrugated.

852,431. JUNCTION BOX. Edwin T. Greenfield, Kiamesha, N. Y. A junction box with a two-part locking sleeve.

852,464. STORAGE BATTERY. Edward Sokal, Binghamton, N. Y., assignor of one-third to Sigmund Bloomfield, Elkhart Lake, Wis., and one-twelfth to Sigmund B. Wolf and one-twelfth to Charles Wolff, Chicago, Ill. One electrode is hollow and porous, the electrolyte being forced through its walls into the cell.

852,468. MOTOR CONTROLLER. Emmett W. Stull, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. A plurality of drums is provided, one for each motor controlled.

852,489. CLUSTER LAMP-SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. Lamp-receiving shells are arranged on opposite sides with a common base.

852,490. TWIN LAMP-SOCKET. Reuben B. Benjamin, Chicago, Ill. A socket with a two-part inclosing sheath.

852,491. PLURAL LAMP-SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. An insulating base with a pair of receiving shells.

852,495. MULTIPLEX TELEGRAPHY. John Burry, Ridgefield Park, N. J. Employs telephone apparatus.

852,502. SIGNALING SYSTEM. Eugene Garretson, Buffalo, N. Y. The system employs inductively derived current.

852,523. AUTOMATIC TELEPHONE EXCHANGE. John G. Roberts, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. The operating lever is heavy and unresponsive to momentary impacts of the actuating magnet.

852,536. RESISTANCE-BOX FOR ELECTRICAL MEASUREMENTS. Frank Aronson, Evanston, Ill. The ends of the contact plates are bent to form sockets for the plugs.

852,539. INDICATING DEVICE FOR ELECTRIC FUSES OR CUT-OUTS. Leonard B. Buchanan, Woburn, Mass. The fuse is shunted by a lamp and a high resistance.

852,548. LIGHTNING CONDUCTOR. William P. Finn, Dansville, N. Y. A system of looped conductors is stretched over the house.

852,569. SECONDARY BATTERY. Lamar Lyndon, New York, N. Y. The envelope for the active material consists of two porous diaphragms of vegetable matter held by a frame of acid resisting material.

852,572. LIGHTNING CONDUCTOR. William H. McCullough, Chicago, Ill. A woven wire tube.

852,575. TELEPHONE EXCHANGE. Nils E. Norstrom, Chicago, Ill., assignor, by direct and mesne assignments, to John Anderson, Salina, Kans., M. E. Richardson, Sterling, Kans., and John H. Martin, and H. Keating. A party-line system.

852,582. ELECTROMAGNETIC SWITCH. Walter Scribner, Columbus, Ohio. A contact plate carried on the armature connects with either of two fixed plates.

852,627. AUTOMATIC ELECTRICAL TRAIN-STOP. Hiram G. Sedgwick, Mill Valley, Cal. The brake valve on the train pipe may be operated by a roadbed device.

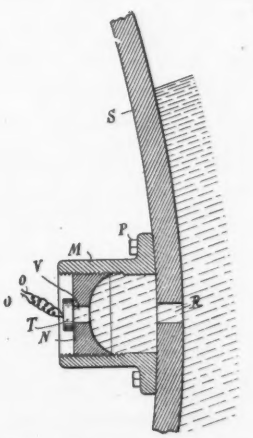
852,628. AUTOMATIC ELECTRICAL TRAIN-STOP. Hiram G. Sedgwick, Mill Valley, Cal. A system of controlling the movement of trains on adjacent tracks.

852,629. ELECTRICAL SWITCH LOCK FOR RAILWAYS. Hiram G. Sedgwick, Mill Valley, Cal. The locking device is operated by an electric motor, controlled from a distance.

852,630. RAILWAY SIGNAL. Hiram G. Sedgwick, Mill Valley, Cal. The motor actuating the signal is controlled by the trains.

852,631. ELECTRICAL TRAIN-STOP. Hiram G. Sedgwick, Mill Valley, Cal. An insulated short rail section is inserted in the line.

852,632. ELECTRICAL TRAIN-STOP. Hiram G. Sedgwick, Mill Valley, Cal. A short rail section is inserted between each pair of block rails.



852,647.—SUBMARINE SIGNALING.

852,633. TRAIN-STOPPING APPARATUS. Hiram G. Sedgwick, Mill Valley, Cal. Stopping devices are placed at each end of each block.

852,634. ELECTRICAL TRAIN-STOP. Hiram G. Sedgwick, Mill Valley, Cal. The circuit controlling the train-stop is normally open when the block is unoccupied.

852,635. AUTOMATIC ELECTRICAL TRAIN-STOP. Hiram G. Sedgwick, Mill Valley, Cal. The locomotive is equipped with magnetically controlled means for setting the brakes.

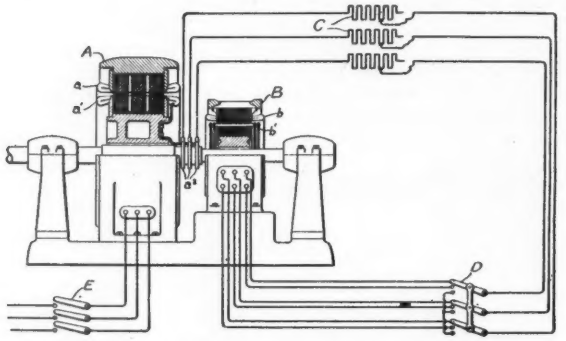
852,639. ELECTRICAL SYSTEM OF DISTRIBUTION. William A. Turbayne, Lancaster, N. Y., assignor to Gould Storage Battery Company. A storage battery and booster system.

852,646. SYSTEM OF SUBMARINE SIGNALING. Lucien I. Blake, Lawrence, Kans., assignor to Submarine Signal Company, Boston, Mass. A system employing submerged transmitter receivers.

852,647. SUBMARINE SIGNALING. Lucien I. Blake, Boston, Mass., assignor to Submarine Signal Company, Boston, Mass. The sound signals are intensified by the resonance of an isolated mass of liquid.

852,648. ART OF SUBMARINE SIGNALING. Lucien I. Blake, Boston, Mass., assignor to Submarine Signal Company, Boston, Mass. The body of the consonant material is interposed between the receiver, or producer, of sound vibrations and the water.

852,649. TRANSMITTER FOR SYSTEMS OF SUBMARINE SIGNALING. Lucien I. Blake, Boston, Mass., assignor to Submarine Signal Company, Boston, Mass. Means for producing sound signals in water.



852,702.—Induction Motor.

852,662. PROCESS FOR ELIMINATING THE ODORS OF FISH-OILS. Alexandre de Hemptinne, Ghent, Belgium. The oil is subjected to a silent electric discharge.

852,675. TELEPHONE EXCHANGE. Nils E. Norstrom, Chicago, Ill., assignor, by direct and mesne assignments, to John Anderson, Salina, Kans., M. E. Richardson, Sterling, Kans., and John H. Martin and H. Keating. A discontinuous conductor extends from the central office to successive stations, means being provided for making it continuous.

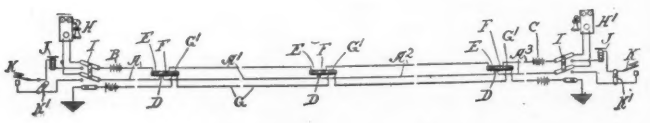
852,680. ELECTRIC ROCK-DRILL. John Riddell and George B. Painter, Schenectady, N. Y., assignors to General Electric Company. A reciprocating hammer.

852,686. BRUSH. George A. Thornton, Schenectady, N. Y., assignor to General Electric Company. A gauze metal strip is electroplated to the end of the brush.

852,687. ELECTRICAL SYSTEM OF DISTRIBUTION. William A. Turbayne, Lancaster, N. Y., assignor to Gould Coupler Company. A system for train-lighting or the like.

852,690. REMOTE-CONTROL DEVICE FOR ELECTRIC SWITCHES. Gilbert Wright, Pittsfield, Mass., assignor to Stanley Electric Manufacturing Company. A step-by-step movement is produced by means of two electromagnets.

852,700. AUTOMATIC DEVICE FOR PRODUCING INTERMITTENT MOTION. Peabody A. Brown, Denver, Col. The motor is automatically reversed.



852,778.—Electric Cable.

852,702. INDUCTION MOTOR. Paul Bunet, Paris, France, assignor to General Electric Company. An auxiliary induction motor, mechanically connected to the main motor, is provided.

852,708. ATTACHING PLUG AND RECEPTACLE. Frank C. De Reamer, Schenectady, N. Y., assignor to General Electric Company. A switch, mounted on the receptacle, closes the circuit and locks the plug in place.

852,711. TELEPHONE TRANSFORMER. John J. Frank, Schenectady, N. Y., assignor to General Electric Company. A transformer with two cup-shaped members.

852,712. TRANSFORMER-CORE. John J. Frank, Schenectady, N. Y., assignor to General Electric Company. The laminations are of different widths.

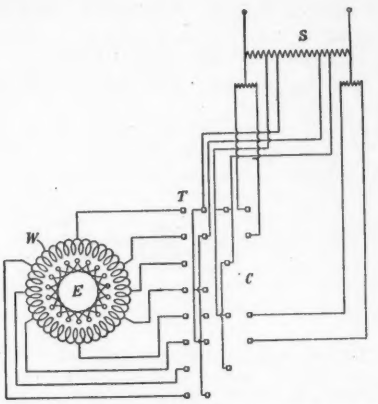
852,724. DEVICE FOR ELECTRICALLY OPERATING BULKHEAD DOORS. David R. Knapp, Philadelphia, Pa. Two circuits are provided, one of variable and one of constant potential.

852,730. INSULATOR. Fred M. Locke, Victor, N. Y. The centre piece is short, cylindrical and threaded.

852,743. APPARATUS FOR REGISTERING TELEPHONIC CALLS. David F. Stakes, Philadelphia, Pa., assignor to Keystone Telephone Company, Philadelphia, Pa. A device for recording the number of the instrument calling.

852,744. APPARATUS FOR REGISTERING TELEPHONIC CALLS. David F. Stakes, Philadelphia, Pa., assignor to Keystone Telephone Company, Philadelphia, Pa. A device with a number of registering discs.

852,766. AUTOMATIC ELECTRICAL CUT-OUT DEVICE. Rudolf Brebach, Leipzig-Reudnitz, Germany. The armature forms a one-armed lever.



853,106.—Alternating-Current Apparatus.

852,773. ELECTROTHERMOSTATIC HEAT-REGULATOR. Lloyd G. Copeman, Spokane, Wash., assignor of one-half to Chas. A. Walker, Cœur d'Alene, Idaho. The solenoid opening and closing the circuit is controlled by a thermostat.

852,778. ELECTRIC CABLE. Robert D'Unger, Chicago, Ill., assignor, by direct and mesne assignments, to the Electric Loop and Cable Company. A series of electrical conductors formed into continuous adjacent circuits, a part of each such circuit being wound upon a common core.

852,806. LOCKING DEVICE FOR TELEPHONES. Francis S. K. Smith and David C. Reinohl, Washington, D. C., assignors to Ralph E. Walker, Washington, D. C. A band engages and locks the receiver hook.

852,851. MOTOR-CONTROLLING RHEOSTAT. Frank J. Seabolt, Schenectady, N. Y., assignor to General Electric Company. A pair of resistances is provided.

852,969. TROLLEY CIRCUIT-FORMER. Gerald R. Livergood, St. Joseph, Mo. A cam having duplicate fingers at right angles, one of which closes the circuit and the other opens it.

853,186.—Telephone.

852,978. TROLLEY. Alfred J. Reif, Allegheny, and Albert L. McCormick, Knoxville, Pa. Guard arms are provided.

853,001. TREMBLER FOR INDUCTION COILS. Charles H. Bryant, Hammersmith, England. A compound lever vibrator.

853,002. TELEPHONE SYSTEM. Edward J. Burke, Brooklyn, N. Y. A plurality of jacks are connected together and to each of a number of substations by a single line.

853,106. ALTERNATING-CURRENT APPARATUS. Ralph D. Mershon, New York, N. Y. The number of poles at the primary element is varied, the winding of the secondary being adapted to this arrangement.

853,107. METHOD OF OPERATING ELECTRIC MOTORS. Ralph D. Mershon, New York, N. Y. The number of poles at the primary element is varied to maintain a high power-factor.

853,118. TELEPHONE RECEIVER HOLDER. Harry E. Richey, Perryville, Pa. An adjustable supporting bracket.

853,186. TELEPHONE. William J. Murdock, Boston, Mass. Means for reinforcing brittle material by means of tough fibrous substances.